Rock Products

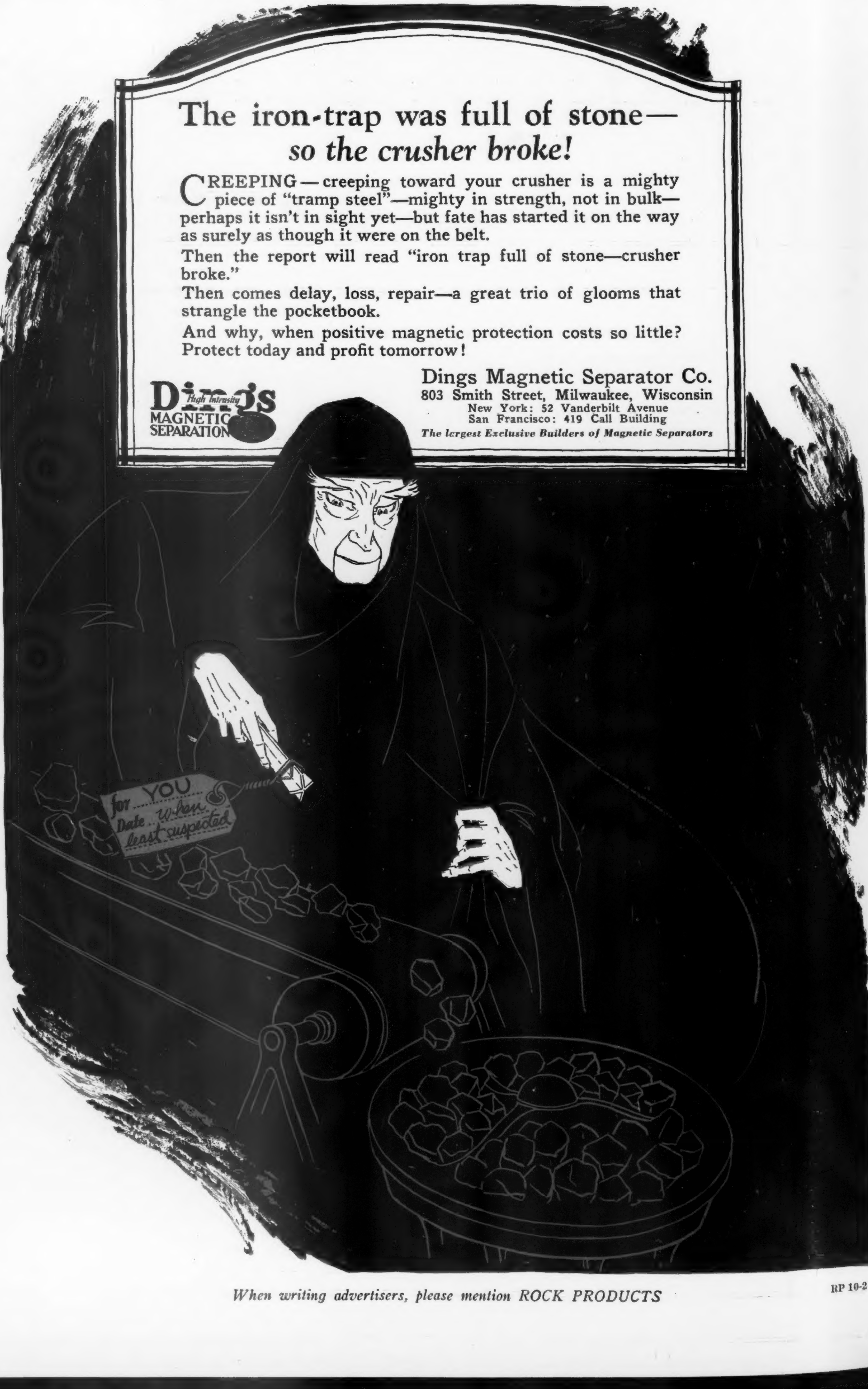
With which is Incorporated CEMENT and ENGINEERING NEWS

Founded 1896

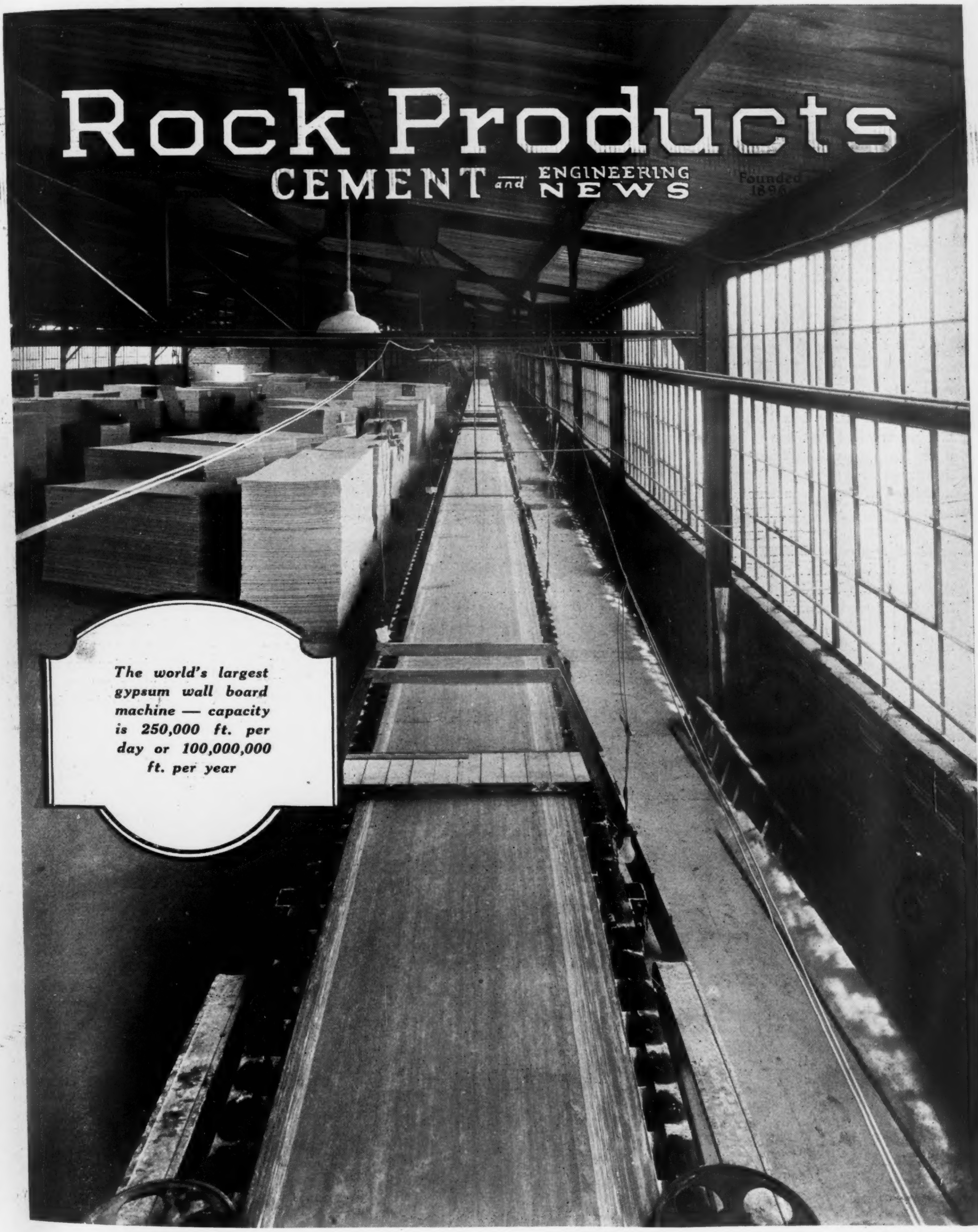
Chicago, October 2, 1926 (*Issued Every Other Week*) Volume XXIX, No. 20

MEMBER A. B. C. *The Only Paid Circulation covering the Rock Products Industry* MEMBER A. B. P.

Printing of This Issue is 5300 Copies. Next Issue Will Be October 16


The iron-trap was full of stone—
so the crusher broke!
CREEPING—creeping toward your crusher is a mighty piece of "tramp steel"—mighty in strength, not in bulk—perhaps it isn't in sight yet—but fate has started it on the way as surely as though it were on the belt.
Then the report will read "iron trap full of stone—crusher broke."
Then comes delay, loss, repair—a great trio of glooms that strangle the pocketbook.
And why, when positive magnetic protection costs so little? Protect today and profit tomorrow!
Dings High Intensity MAGNETIC SEPARATION
Dings Magnetic Separator Co.
803 Smith Street, Milwaukee, Wisconsin
New York: 52 Vanderbilt Avenue
San Francisco: 419 Call Building
The lcrgest Exclusive Builders of Magnetic Separators
for YOU
Date when least suspected

Volume XXIX Chicago, October 2, 1926 Number 20



Interior of the new wall-board plant of the National Gypsum Co., near Clarence, N. Y.

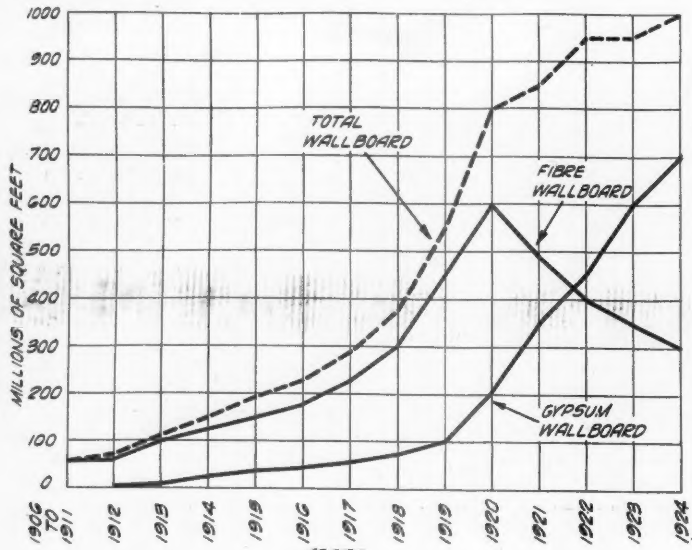


Chart showing the relation of the pulp-board and gypsum wall-board production

Gypsum Wall-Board Machine with a Capacity of 100,000,000 Feet of Board a Year

National Gypsum Company, Clarence, N. Y., Has Pace-Maker for Wall-Board Industry

THE GROWTH of the gypsum wall-board industry has been astounding; and we are told that it was largely forced upon the gypsum manufacturers by those in charge of war-time construction. The necessity of rapid construction of buildings for army cantonments and other government uses turned builders' and engineers' attention to wall-board, and the wood-pulp board, then being actively promoted, failed to stand up satisfactorily, even in temporary construction. The government engineers then turned to the use of gypsum wall-board, which was at that time made in very few places, and forced up production to the limit, under threat of taking over the plants, if government demands were not met. How true these things are we do not know, but it is a fact that war-time construction put the gypsum wall-board industry on the map, and nothing since has been able to stop its growth.

No better illustration of the growth of the gypsum wall-board industry could be given than the success of the new plant of the National Gypsum Co. at Clarence, N. Y., which has an initial capacity of between 75,000,000 and 100,000,000 sq. ft. of board. The entire output of gypsum wall-board in 1924 was only 700,000,000 sq. ft. And this plant is designed throughout for duplication of the present board-making facilities, doubling its capacity!

The new National plant is notable because it is the first gypsum products operation designed to make wall-board exclusively. Other manufacturing units will soon be added to make partition tile, etc., but the plant as it stands is *designed* to make wall-board, and these other products will be more in the nature of by-products. It is notable because it has the longest wall-board machine and the longest wall-board dryer in the industry.

Mine of the National Gypsum Co. showing width of gypsum vein

The board machine is 625 ft. long and the dryer 350 ft.—100 ft. being added after the original installation was made. The board machine and dryer have a capacity of about 250,000 ft. per day of 24 hours.

The National Gypsum Co. plant near Clarence, N. Y., about 10 miles northeast of Buffalo, is the western-most of the plants in the Akron, N. Y., gypsum field. The company owns outright or controls the mineral rights of over 1000 acres of land under which lies an almost level stratum of exceptionally high grade gypsum rock over 4 ft. thick containing over 10,000,000 tons. The gypsum stratum is overlaid by a solid bed of limestone which forms the roof of the mine.

Mining Operation

The mine shaft is located in the center of the deposit which is a decided advantage, as the entire deposit may be mined without having any long hauls to the shaft. The mine is comparatively dry and very little pumping is necessary.

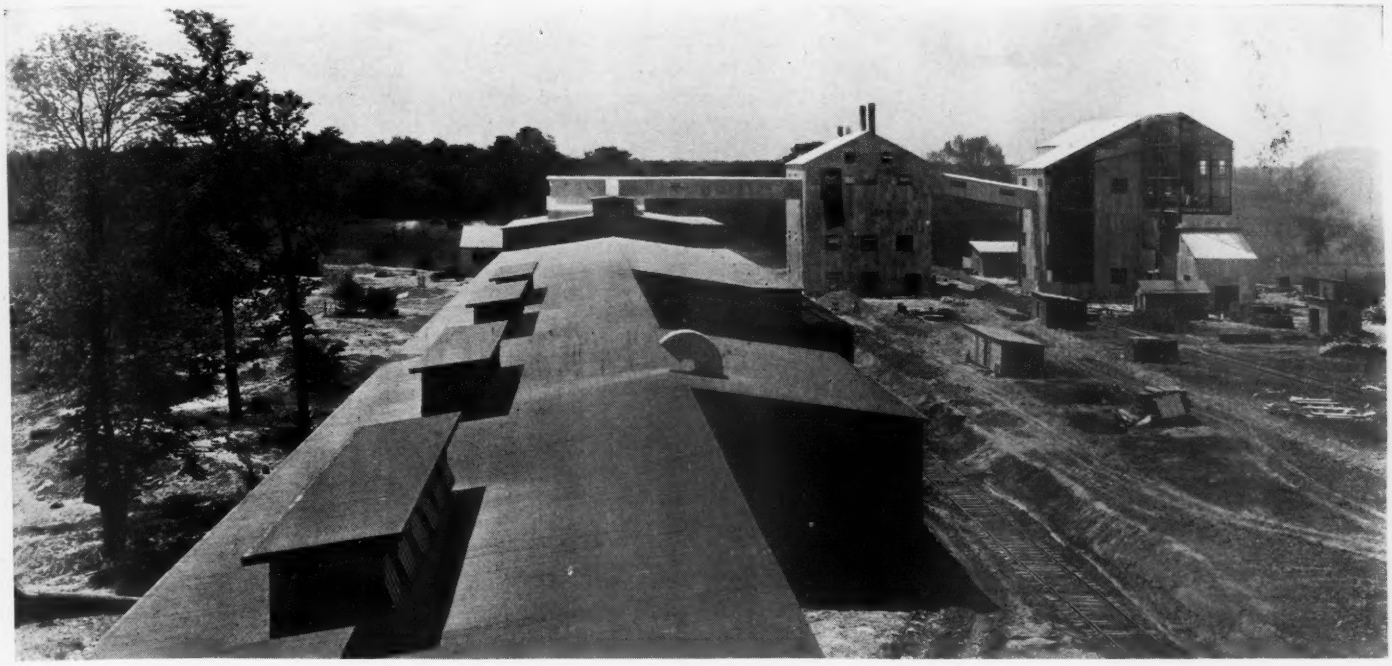
The gypsum is mined by what is known as the room and pillar system. The entries are driven from the main haulageways and the rooms are driven from the entries at intervals and pillars left between the rooms to support the mine roof. This system of mining gypsum rock is almost universal in this district and requires very little timbering.

The rock is drilled with Scranton electric auger drills, and the holes are then loaded with 20% dynamite. The drilling is done during the day and the shots or blasting done in the evening after the miners are out of the mine.

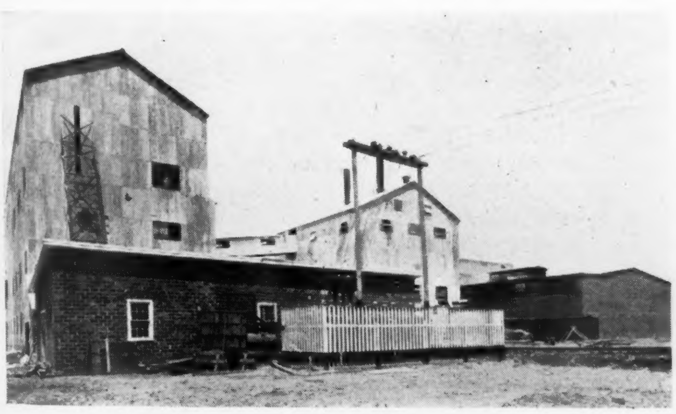
The product of the blast is loaded by hand into steel mine cars of two tons capacity each, which are hauled to the mine shaft. These cars are equipped with roller bearings and were furnished by the Ottumwa Iron Works.

Direct-current power for the mine is supplied by a Fuerst-Friedman Co. motor-generator set—the motor is 30-hp., 440 v., 1420 r.p.m. and the generator makes 80 amp. at 250 v.

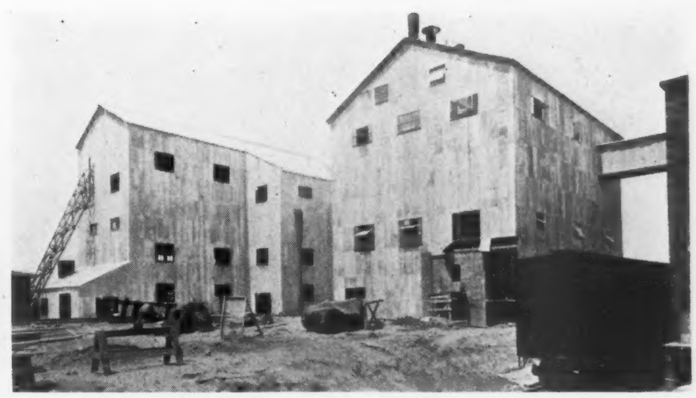
The depth of the mine shaft is 54 ft. from the surface to the bottom of the



General view of the National Gypsum Co. plant—roof of wall-board plant in foreground—calcining plant and mill building at right



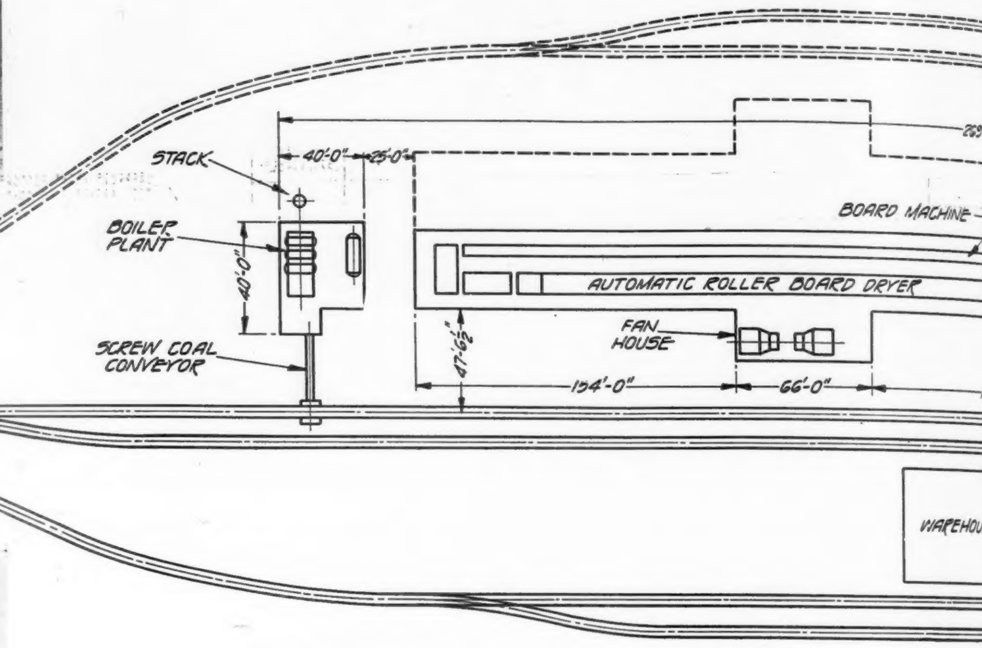
Transformer station and mine hoist house



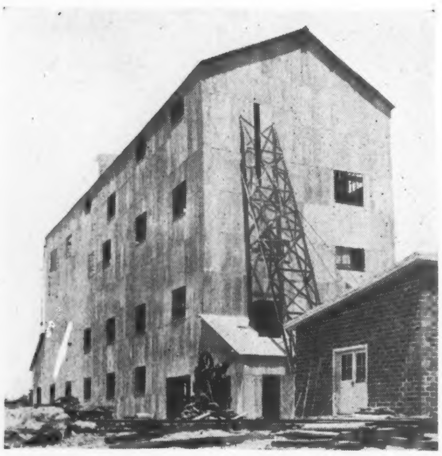
Mill building (left) and calcining building (right)

The building housing the wall-board machine and dryer

Boiler house for dryer



General plan of the National Gypsum Co. plant



Mill and mine hoist buildings

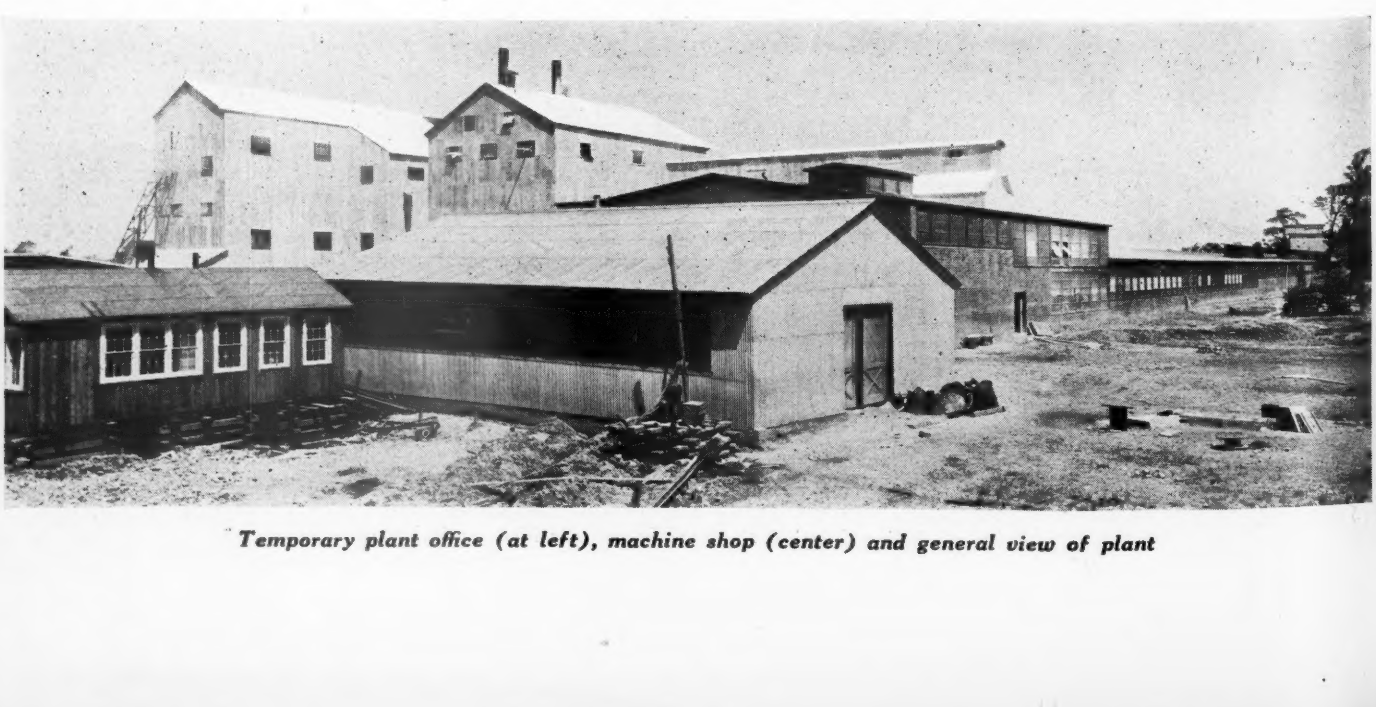
mine floor. This is a vertical shaft 8 ft. wide by 20 ft. long consisting of two compartments for the mine cages, one compartment for the stairway to the mine and one compartment for the air shaft. The shaft is equipped with two automatic self-dumping cages which were furnished by the Robert Holmes Co.

The loaded mine cars are placed on the cages, and as one cage goes up with the loaded car the other cage goes down with an empty car, making the operation continuous. The cages are operated by an electric-motor operated hoist, equipped with a solenoid brake and a hand brake. The hoist was furnished by the Vulcan Iron Works. The motor is a slip-ring motor, 40-hp., 440-v., 696 r.p.m.

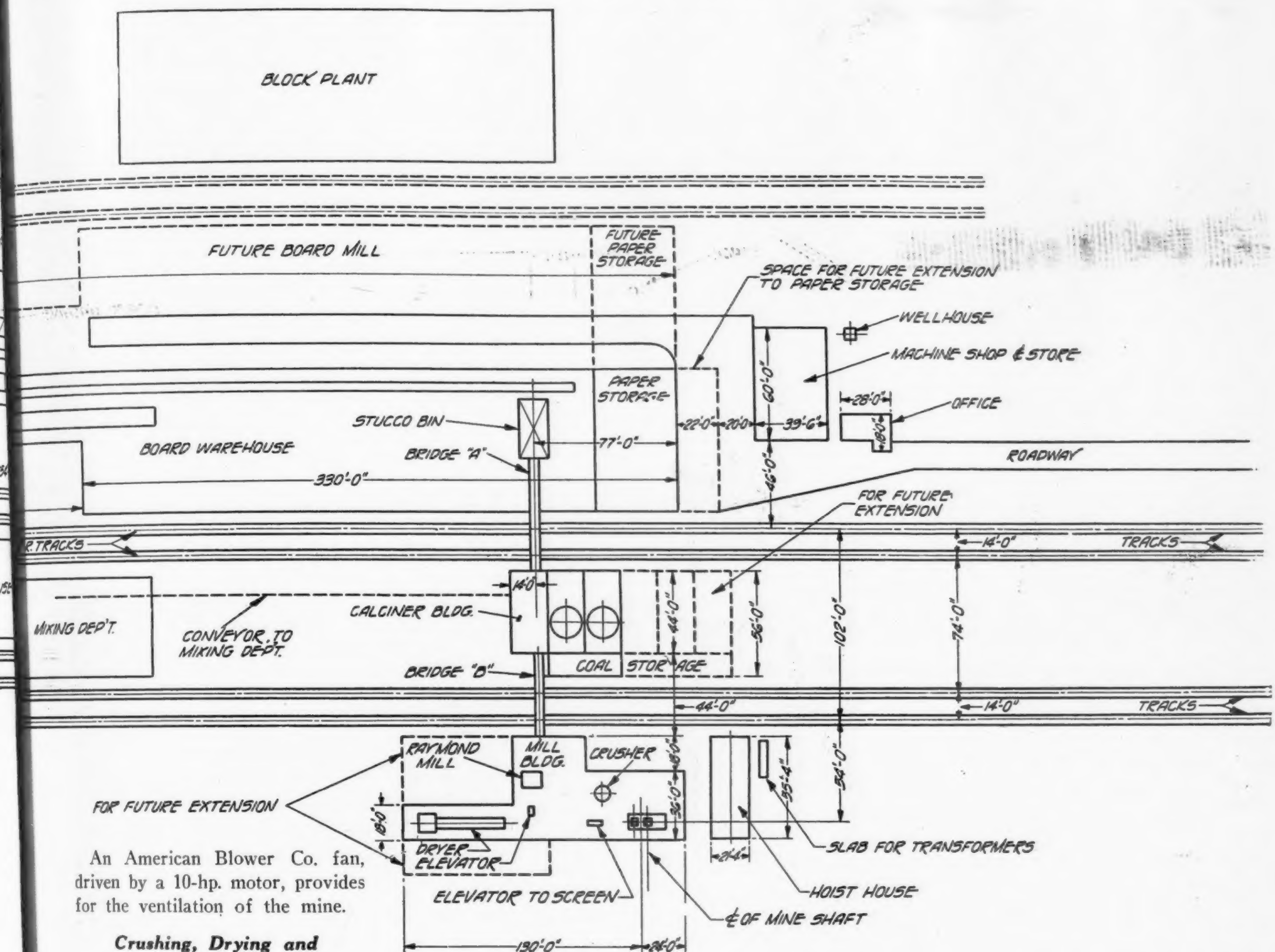
The cars are automatically locked on the cage as it leaves the foot of the shaft, and when the cage reaches the top the gate of the car is automatically raised and at the same time the cage platform is carried to a 45 deg. angle and the contents of the car are dumped into steel weighing hoppers. The weight of the rock in the weigh hoppers is recorded on quick-weighing, springless, dial scales, furnished by the Fairbanks Co., which have a capacity of 6000 lb. each.

Each car carries a check giving the number of the loader and the operator records the weight of each car of rock on his weigh sheet opposite this number. In this way a daily record is kept of the tonnage loaded by each man in the mine. As soon as the weight is recorded the operator trips the weigh hopper discharging the rock, and signals the cager at the foot of the shaft by means of an electric bell, indicating that he is ready for another car. The capacity of the mine hoist is in excess of 150 tons per hour.

The mine-shaft head-house is located in what is known as the mill building, and in this building are also located the crushing, screening, drying and grinding departments. This building is designed so that any department may be enlarged to meet any capacity desired for future expansion of the rest of the plant.



Temporary plant office (at left), machine shop (center) and general view of plant



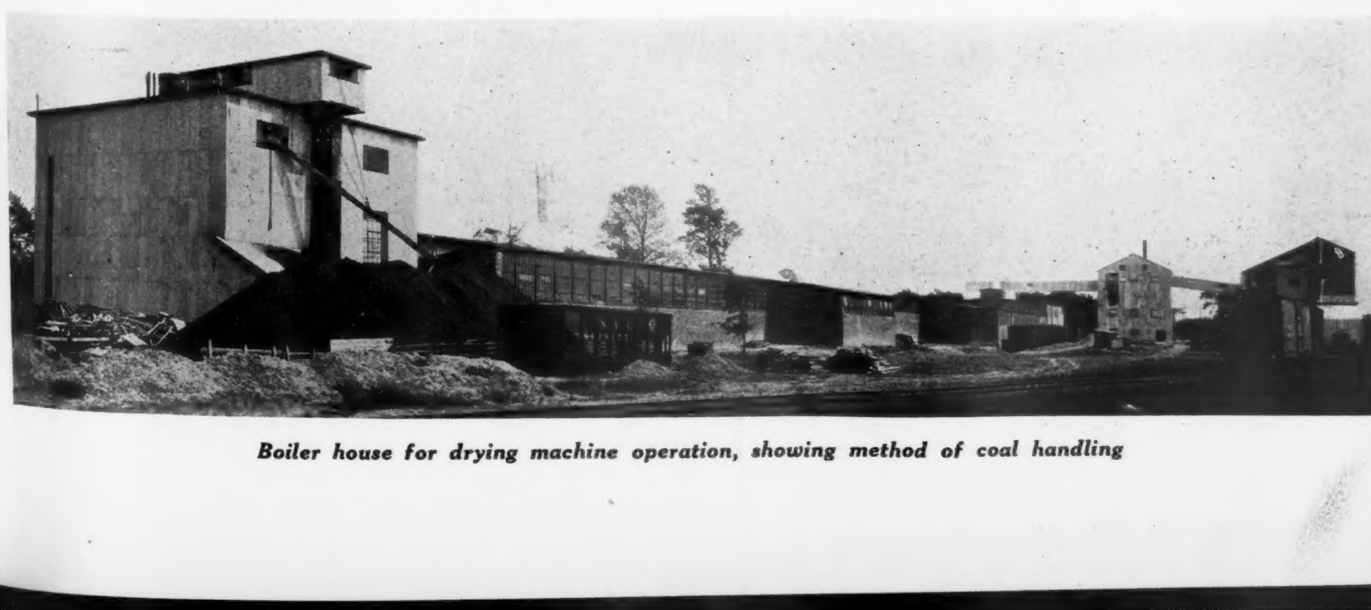
Block plant, not built as yet

An American Blower Co. fan, driven by a 10-hp. motor, provides for the ventilation of the mine.

Crushing, Drying and Pulverizing

As the operator trips the weigh hopper the rock is discharged on to an extra heavy Jeffrey apron conveyor feeder, which carries it to the crusher. This apron feeder is driven by a 5-hp., 440-v. motor and can be regulated to run at any proper speed to give a uniform continuous flow of rock to the crusher. The crusher is a 42x36 in. Jeffrey rigid-hammer crusher, and has a capacity of 150 tons of mine rock per hour, reducing to 1¼-in. and under, and is driven by a 100-hp. 440-v., 750-r.p.m. motor One operator located on the cage floor landing takes care of the hoisting, weighing, dumping, as well as tending to the crusher feed.

The crushed rock is delivered to a belt conveyor under the crusher which is fitted with a Dings magnetic head pulley to remove any tramp iron which may be in the rock and prevent it from getting into the grinding machinery. The belt conveyor delivers the crushed rock to a continuous bucket elevator which carries it to a revolving screen which is located at the top of the building. This screen is used to size the rock required for various purposes. The small size rock and fines are delivered to a belt conveyor which delivers to the rock dryer bin. The medium product from the screen is delivered on to a conveyor belt, which carries it to cars, and is shipped as commercial rock, or it is carried to the rock storage pile. The oversize rock is delivered to a chute and carried back to the crusher for further crushing. Under the screen are two



Boiler house for drying machine operation, showing method of coal handling

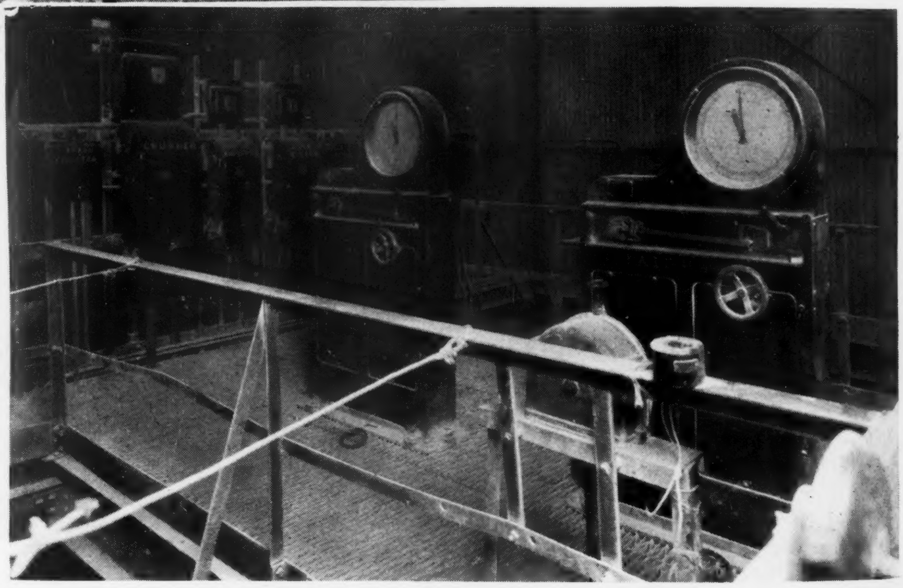
Pan-conveyor feeder, hammer mill and drive

parabolic-bottom steel bins for crushed roof rock, which can be shipped as commercial crushed stone.

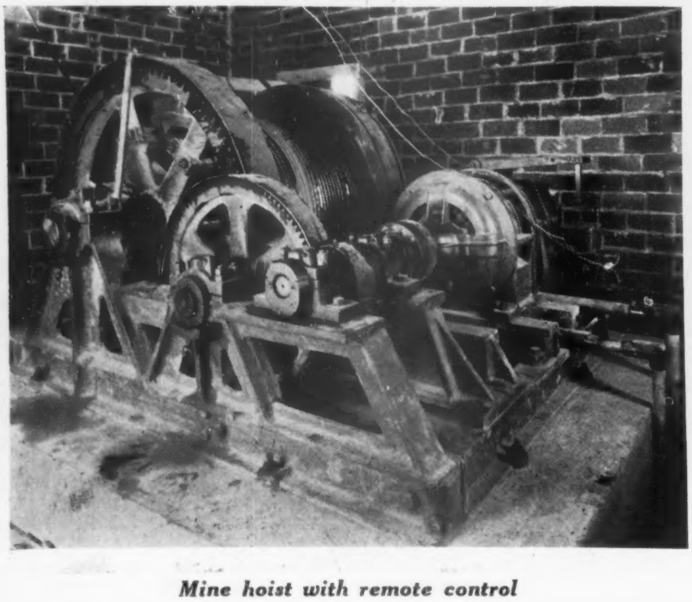
The conveying system and rock screen are so arranged that the product from the crusher may by-pass the screen, and be delivered to the rock-dryer, storage pile or shipped as commercial rock without any screening if it is desired to do so.

The rock dryer bin is a steel parabolic suspended bin of 600 tons capacity located above the rock dryer. The bottom of the bin is supplied with gates and an automatic, reciprocating, rock feeder, which feed the rock on to a belt conveyor in a continuous flow which carries it to the rock dryer. The 5x40-ft. rock dryer is the direct-heat rotary cylindrical type, fitted with lifting flights which tumble the rock around inside of the shell. It is driven by a 25-hp. motor through a belt and countershaft. The dryer is slightly inclined to carry the rock continuously from the intake to the discharge. Coke is used to fire the dryer in order that no rock will not be discolored by the gases. The dryer fan (Clarage) is located at the discharge end of the dryer which draws the hot gases from the dryer furnace through the dryer. The circulation through the dryer picks up the dust and fine particles of rock which is delivered by the fan to a cyclone dust-collecting system. The dust collectors collect the gypsum dust and the moisture which is removed from the rock is vented out through the roof. Between 2 and 3% of free moisture is removed from the rock in the dryer.

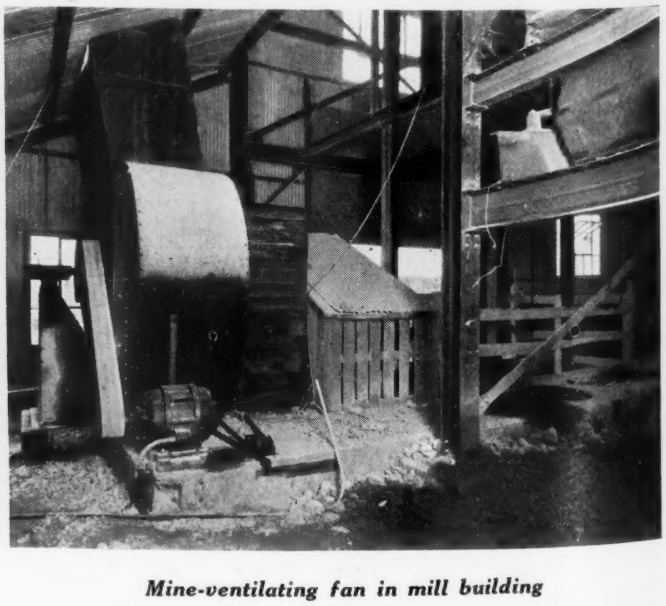
The rock dryer and the dust-collector deliver the dried rock to a continuous



Dial scales on weigh hoppers; below, feeding mills—at right are the motor controls



Mine hoist with remote control



Mine-ventilating fan in mill building

Rotary direct-heat dryer using coke for fuel

bucket elevator which carries it to the dried rock bin. This bin is a steel parabolic suspended bin of 600 tons capacity and is located above the Raymond mill which is used to grind the dried rock for calcination.

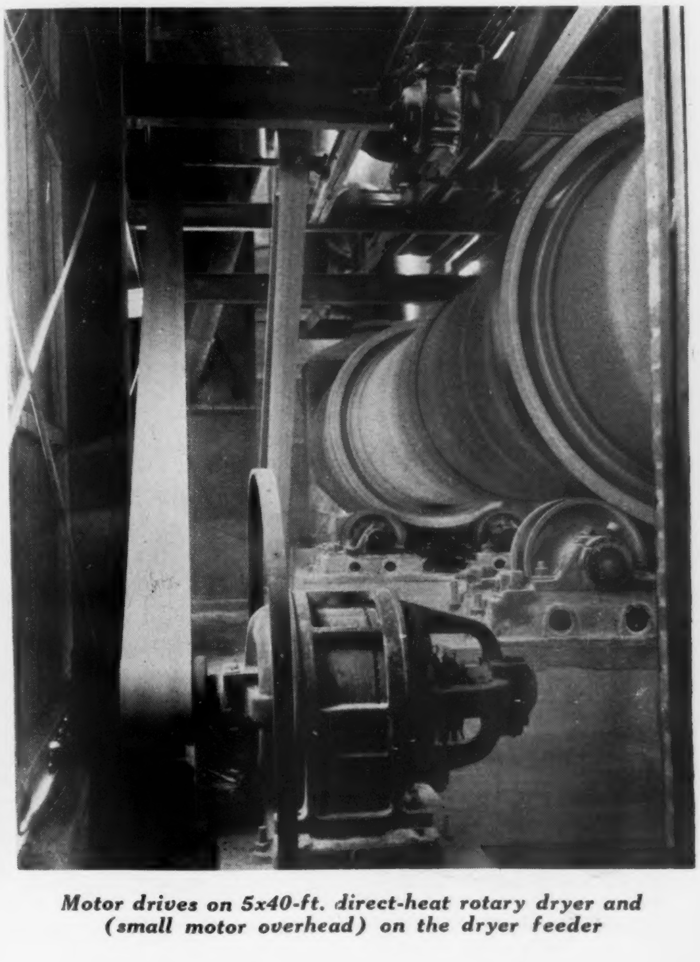
From the storage the dried rock is spouted to the automatic feeder which feeds the Raymond mill. This is the latest improved No. 5 low-side Raymond mill equipped with heavy rolls, wide-faced bull-ring, automatic feed control, improved vacuum air separator, return air housing, exhaust fan and cyclone dust collector. The Raymond mill grinds the dried rock to a fineness so that 95% will pass through a 100-mesh screen, at the rate of 10 tons per hour. The Raymond mill is operated by a 75-hp. motor and the fan by a 50-hp. motor. The product from the Raymond mill is now ready for calcining and is delivered to a screw conveyor which carries it over a bridge to the calcining mill.

Calcining Mill

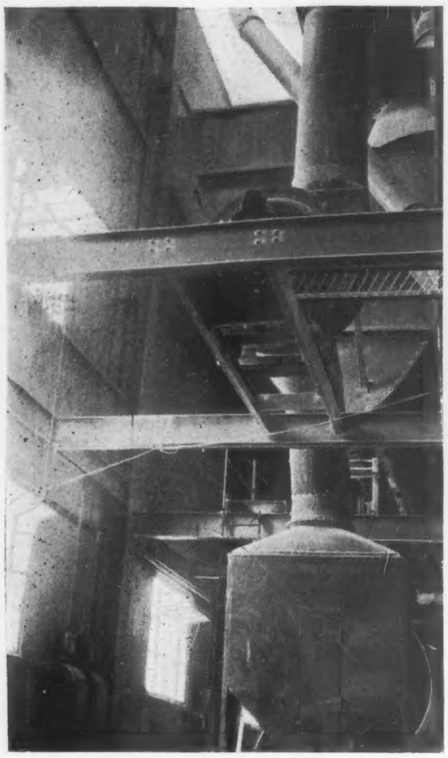
The ground gypsum is slowly fed into the two calcining kettles, which are coal fired, heated to a temperature of 330 deg. F., in order to drive off 75% of the water of crystallization. The ground gypsum as it comes from the Raymond mill in the mill building is delivered to two steel parabolic suspended bins which are located above the kettles, and is slowly fed to the kettles from the bins by screw conveyors. At the present time there are two 10 ft. 10 in. specially designed kettles in operation, which were made by the J. B. Ehrsam and Sons Co. Each kettle holds 14 tons of material and it requires about one hour and 30 minutes to calcine each batch. The kettles are equipped with recording thermometers, as well as ordinary mercury thermometers.

The kettles are equipped with a specially designed steam and dust-collecting hopper, under the roof of the building, through which the kettles are vented. The vent stock is at one end of this hopper, and the steam and dust from the kettles have to pass through this baffled hopper to reach the stack. The dust-collecting hopper is discharged by a screw

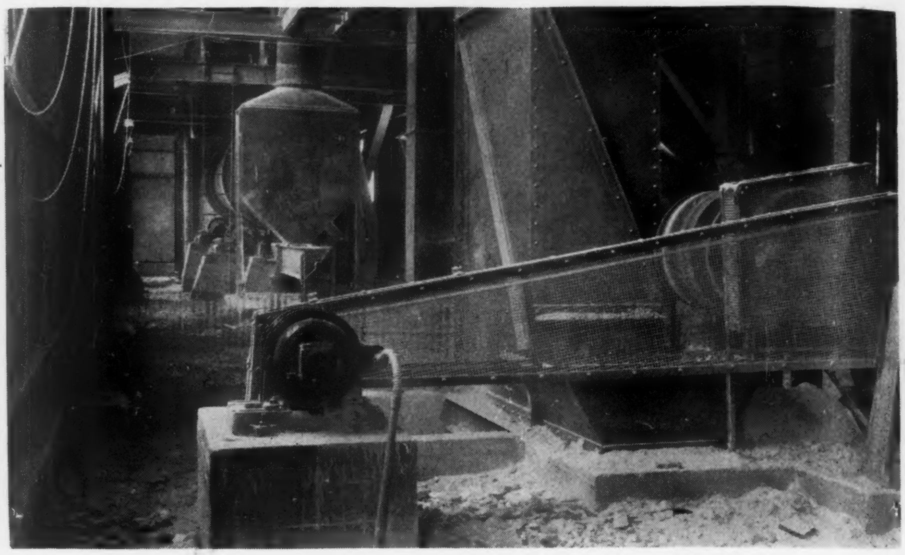
Weigh hoppers, pan-conveyor feeder, hammer mill and belt with magnetic separator feeding elevator to pulverizer



Motor drives on 5x40-ft. direct-heat rotary dryer and (small motor overhead) on the dryer feeder



Dust collecting system on rotary dryer and conveying equipment



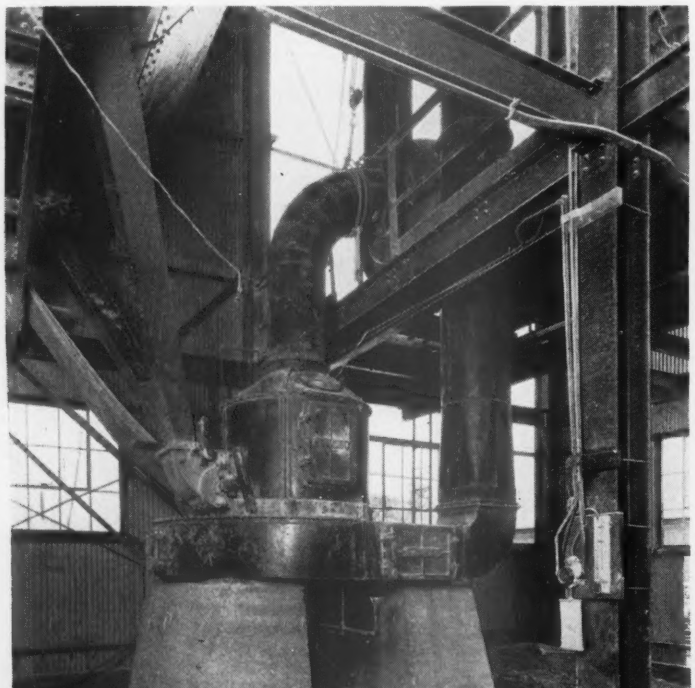
Looking from top of mine shaft toward rotary dryer, showing drive on belt conveyor from hammer mill to elevator

conveyor, eventually to feed direct back into the kettle-feeding bins. At present the dust is discharged through a chute on the firing floor of the kettle room, and returned to the raw gypsum bins.

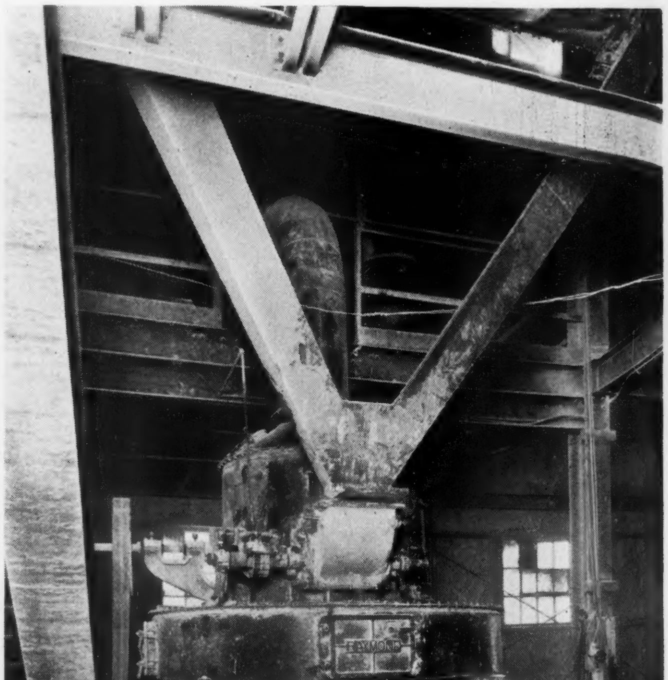
The kettles are drawn, or emptied, from the top floor level where all the thermometers and controls are. The hot pit is directly under the control floor and is provided with electric lights, and has a walk-way through it, so if occasion demands that workmen go into the pit, they do not have to get into the stucco. A peep-hole in the floor, beside each kettle discharge gate-handle, permits the kettle operator to inspect the draw, and shows him if the kettle is "hung" for any reason as well as inspect the draw.

The kettle agitators are driven by a single 20-hp. motor between and over the tops of the two kettles through a chain drive, a line shaft and friction clutches. The same motor, through the kettle agitator gears and chains, drives the screw conveyors of the feed bins.

The hot pit is discharged through eight screws, driven by gears from a line shaft, which in turn feed a common screw conveyor in the rear of the kettles and hot



Pulverizer with air separation and automatic feed control



Another view of pulverizer; feed control device on post at right

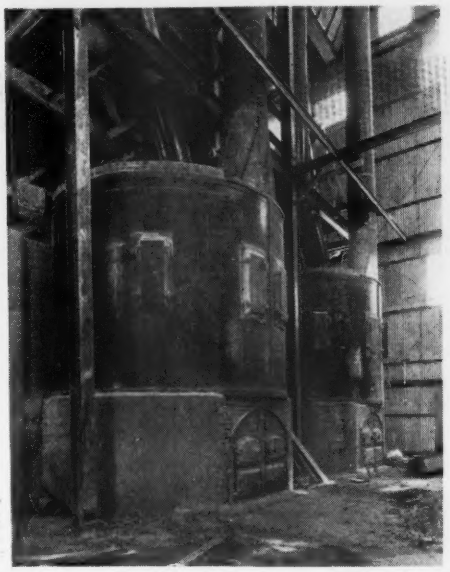
Shipping raw rock for cement plants

pit. This screw conveyor carries the stucco to a bucket elevator, which elevates it to a vibrating screen in the upper part of the calcining building. From the screen the stucco is conveyed to the wall-board building.

Wall-Board Plant

As the stucco comes from the calcining building it is delivered into a steel hopper-bottom, suspended bin having a capacity of 300 tons. A steel drag chain is located in the bottom of this stucco bin which delivers a continual flow of stucco to the board machine mixer. This feeder is driven through a Reeves speed regulator and a Jones speed reducer and can be run at any speed required to give the feed to the mixer. The mixer is located over the board machinery and delivers a continuous supply of mixture directly on to the machinery. This feeder also delivers to a bin over a 3-valve Bates bag packer. This is the only provision for shipping stucco for plaster and is installed as a convenience to dealers, who insist on getting their plaster orders filled here.

The bottom paper is drawn off a roll located over at the rear of the board machine and passes along the machine under the mixer where it receives the stucco from the mixer. The top paper is located over the machine ahead of the squeeze rolls and is brought around under the top squeeze roll. The stucco mixture is delivered on to the bottom paper just before it passes through the squeeze rolls and the top paper comes through at this point to meet it.

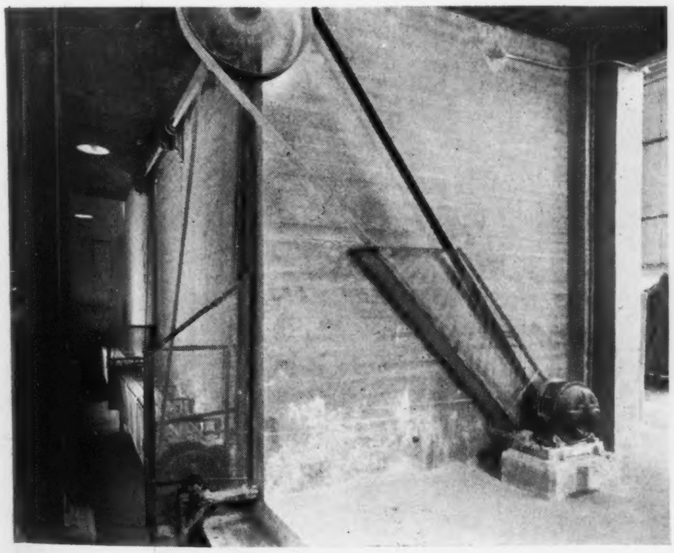


Special calcining kettles

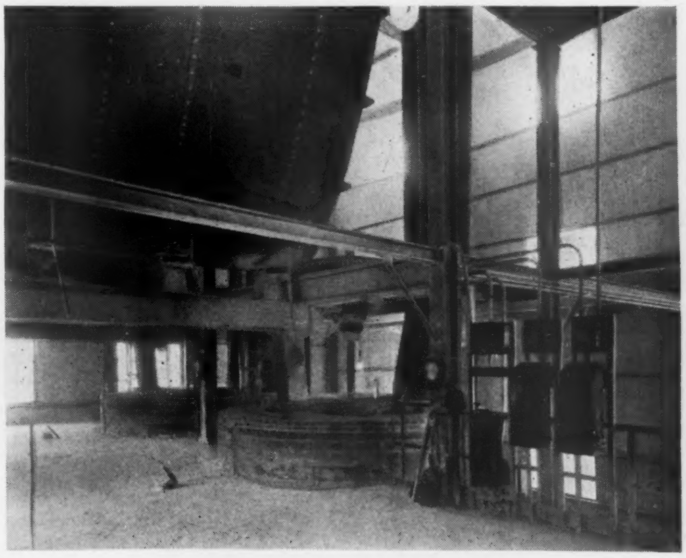
The first half of the board machine, after the gypsum mixture has been placed between the rolls of paper, is a 54-in. flat, rubber belt conveyor, about 300 ft. centers, with an automatic gravity take-up near the center. This conveyor is driven from the head pulley by a 20-hp. motor through a Reeves double-cone pulley drive, so that very fine adjustments of speed may be accomplished. The belt rides on ball-bearing idlers, spaced about 6 in. apart. The stucco feed and other moving parts of this part of the wall-board machine are driven from a line shaft from this single motor.

Calcining building

From the end of the belt conveyor the board is pushed upon a ball-bearing roll carrier, or conveyor, consisting of ball-bearing idlers (made by the Alvey-Ferguson Co.) with every 30th roll driven from a line shaft which in turn is driven at the discharge end of the carrier by a 2-hp. motor through chains and sprockets. Near the end of the conveyor the board is cut

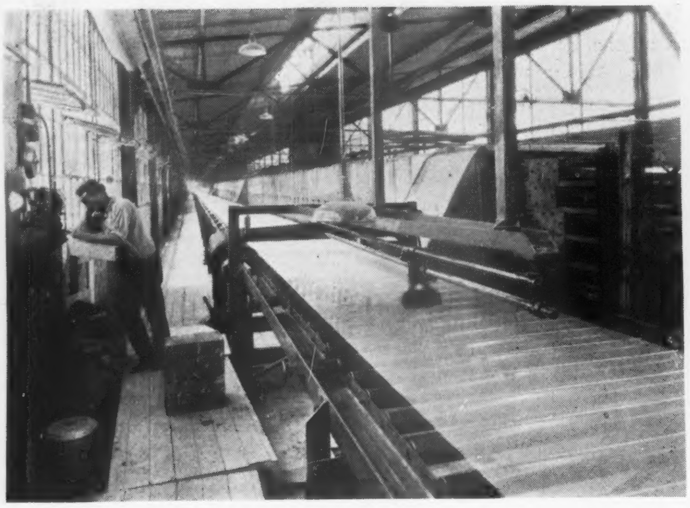


Rear of hot pit, showing discharging method

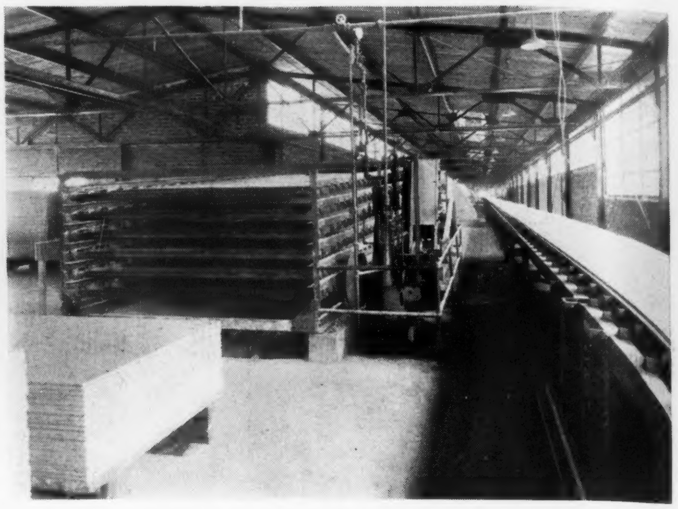


Parabolic-bottom feed bins over kettles

Looking down on tops of calcining kettles, showing drives



Cut-off end of board machine—transparent effect is result of time exposure on moving boards

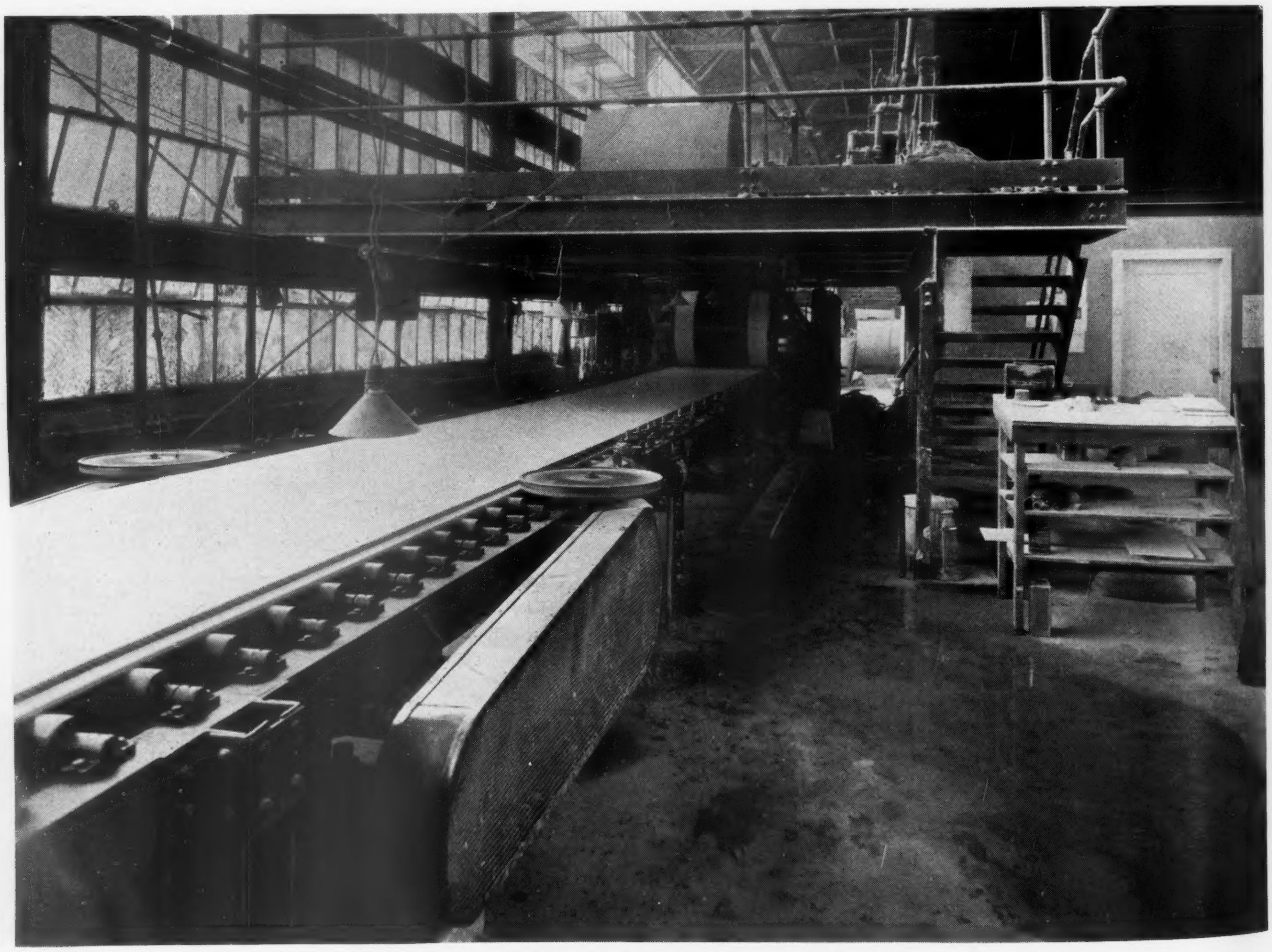


Steam-engine drive on wall-board dryer guards against electric current troubles

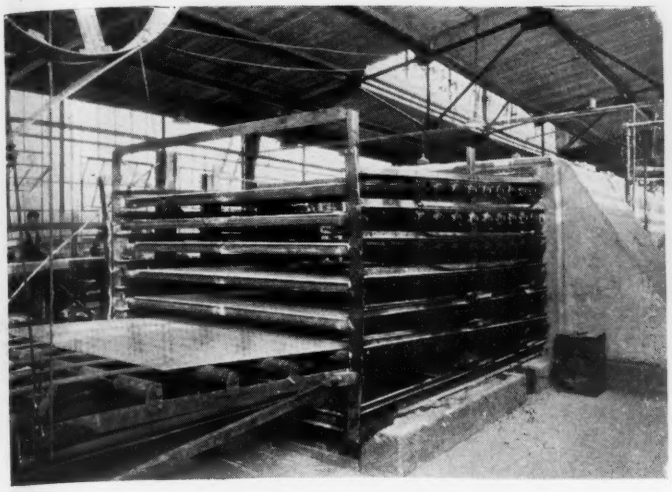
automatically into any desired length by a Knowlton cutter.

The "green" boards then run upon a cross conveyor (or shifter) to the feeder of a Coe wall-board dryer. A 5-hp. motor running at 710 r.p.m. operates this shifter. The shifter is controlled by a single operator, who places the boards on any desired tier of the dryer, where ball-bearing driven rolls propel the board through the dryer. The dryer rolls are operated through chain drives by a small vertical steam engine through Reeves cone pulleys, which gives any speed desired. It was considered necessary to use the steam engine drive rather than an electric motor, because of the danger of the electric current being temporarily off, with the hazard of ruining all the board that happens to be in the dryer.

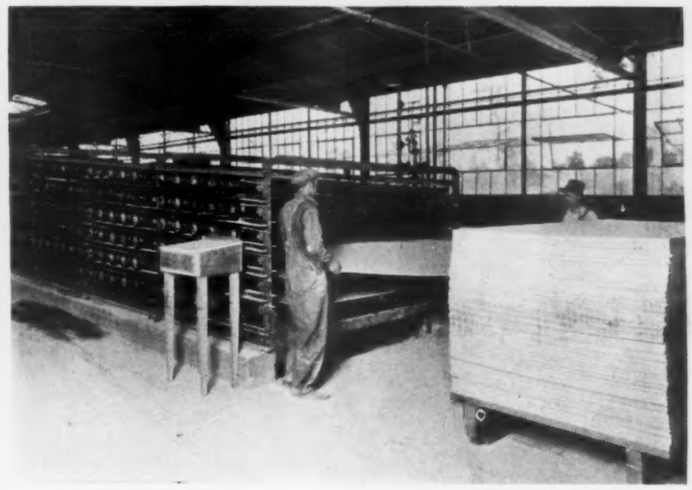
The Coe dryer is the longest yet constructed for the gypsum industry. The 50-hp. hot air-circulating fans are completely enclosed in Banner rock wool (Banner Rock Products Co.). The steam heat for the dryers is supplied by a 504-hp. Sterling boiler equipped with a Mur-



Looking toward the mixer end of the board machine



Green boards entering the dryer



Removing finished board from dryer

phy stoker operated by the latest type hydro-motor. The boiler is in a separate building, at the end of the board machine building.

The dryer is equipped with three recording thermometers, which register temperatures of about 165 deg. at the discharge end, 240 deg. near the center and 280 deg. at the inlet end.

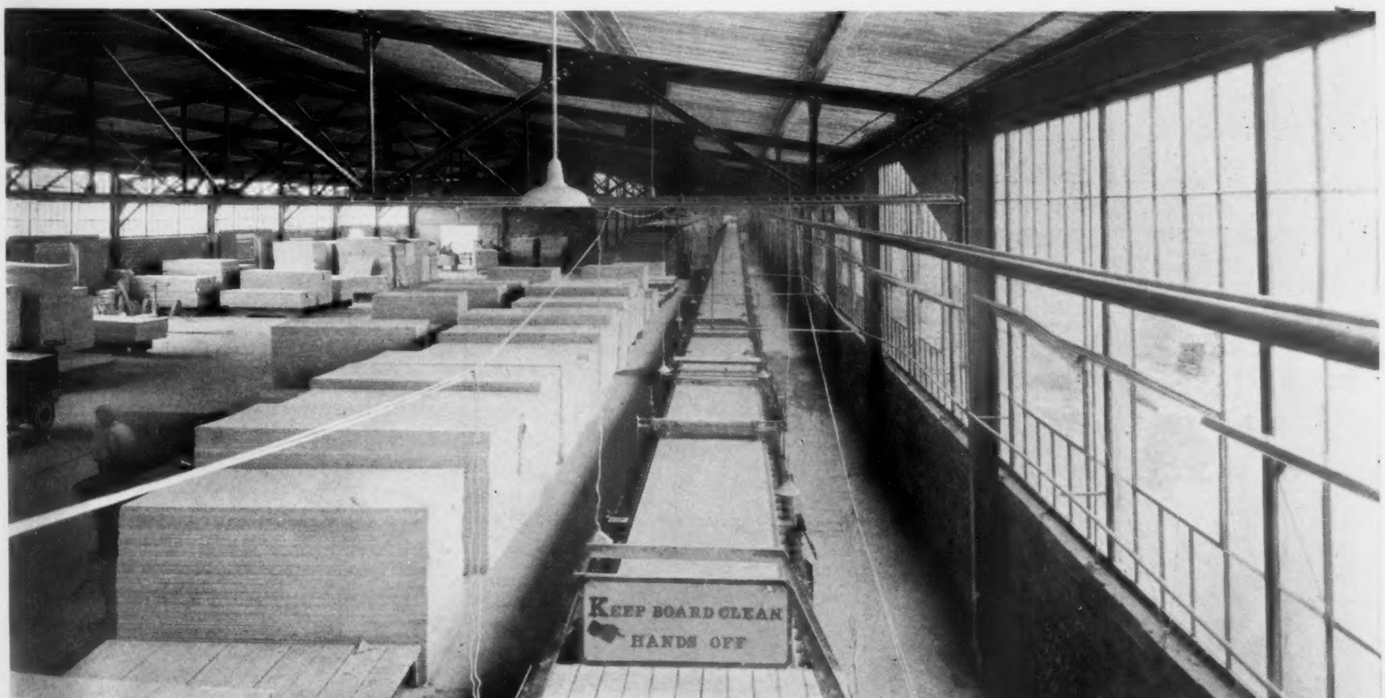
Besides the hot air-circulating fans there is an air-conditioning fan which exhausts the air from the kilns when a certain degree of humidity has been attained.

Summary

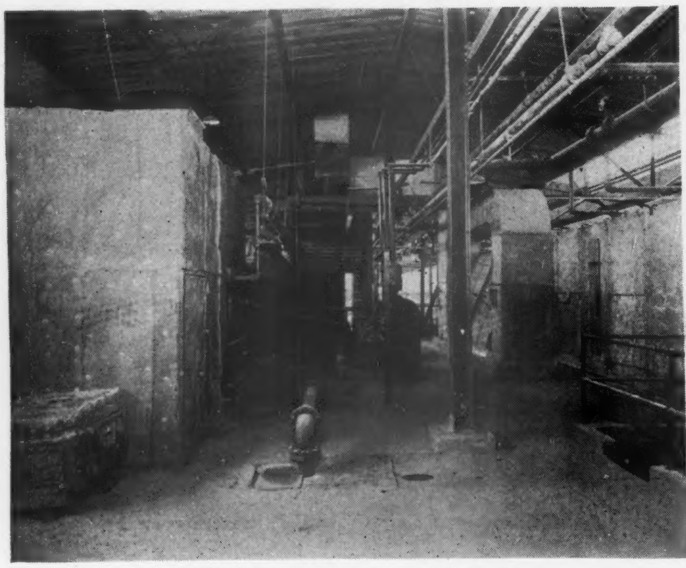
The mill is equipped with General Electric Co. motors throughout and power (3-phase 25-cycle) is brought in from Niagara Falls generators. The elevating and conveying equipment used throughout is of special design and substantially built and was furnished by the Jeffrey Manufacturing Co. The conveyor belts were furnished by the Republic Rubber Co. and transmission belts by the Manhattan Rubber Co. The Beacon Electric Construction Co. furnished the electrical equipment and installation outside of the motors and transformers. The transformers, of which there are three—200 k.v.a. each, were furnished by the Maloney Electric Co.

Actual construction was started the middle of last December and the entire plant was completed and put in operation on June 1. This is believed to be a record for building a complete gypsum plant from mine to finished wall-board.

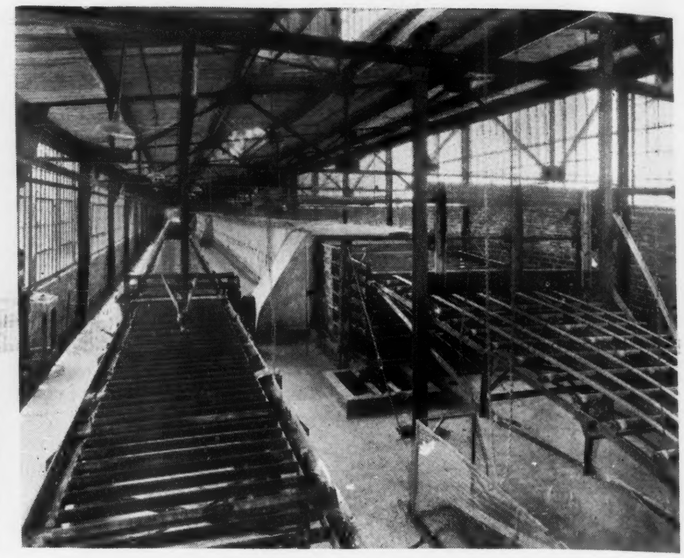
Particular attention has been given to the design and layout of the entire plant so as to reduce the number of men required for operation and to allow for



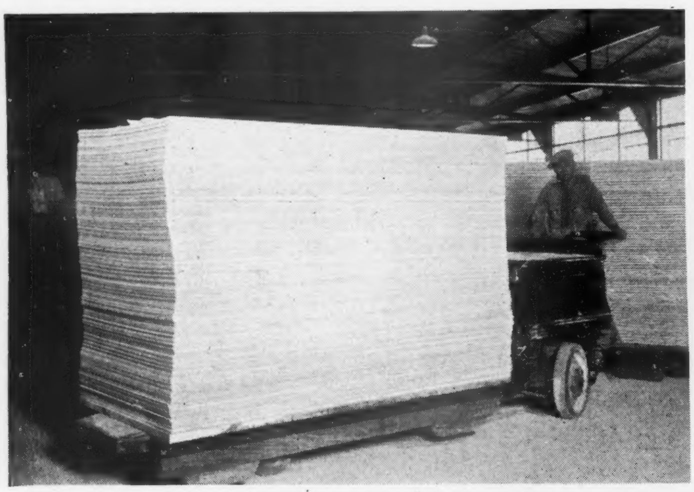
Looking down the board machine from the top of the mixer platform



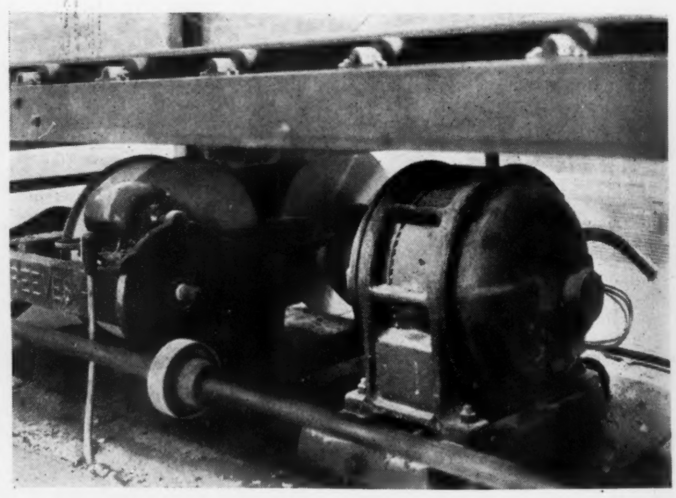
Fans for circulating air in dryer



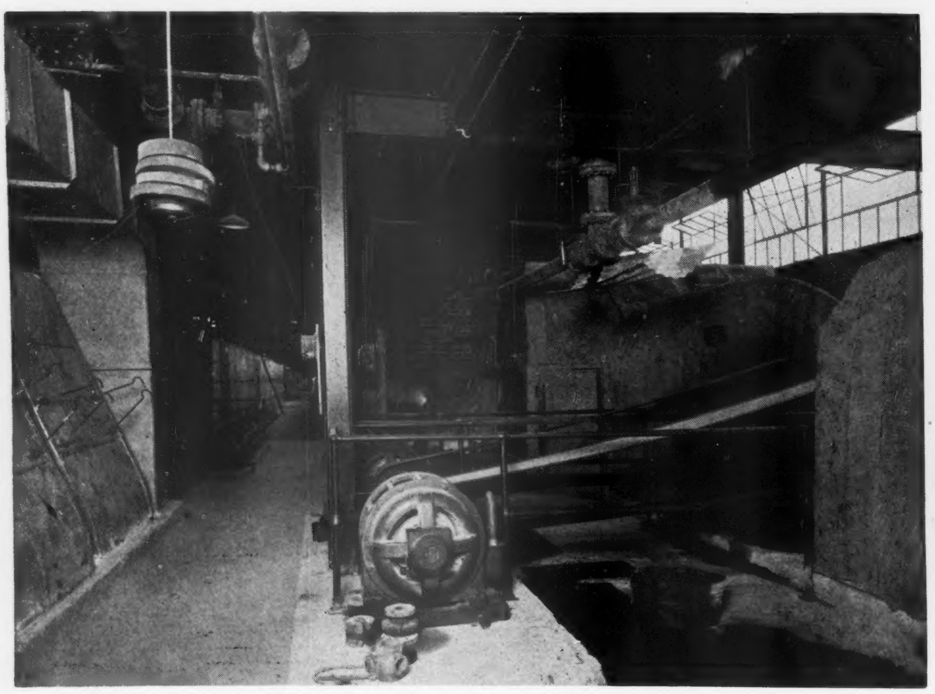
Board machine, left, dryer on right



Electric truck handles finished boards



Wall-board machine drive—double-cone speed adjustment —this motor, through shaft shown below, drives feeding mechanism also



Wall-board drying machine details—fans and drives

Boiler for dryer is equipped with automatic stoker driven by the latest type of equipment for this purpose

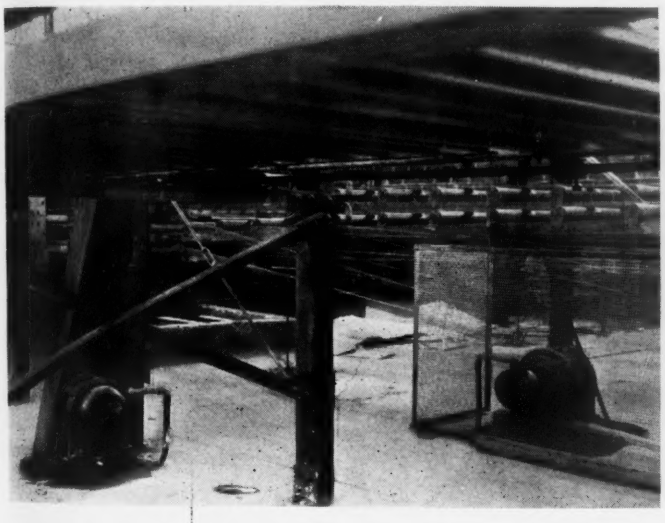
future expansion. From the time that the gypsum rock is loaded on the cars in the mine until the wall-board is loaded on the cars for shipment the entire manufacturing process is an automatic continuous flow.

Personnel

J. F. Haggerty is president of the National Gypsum Co., the home office of which is in Buffalo, N. Y.; C. E. Williams is vice-president and treasurer; M. H. Baker, general sales manager; Robt. Holderbaum, superintendent; John J. Turner, production manager; A. H. Bruner, production engineer, and Thomas Thomas, mine superintendent. All are experienced gypsum manufacturers.

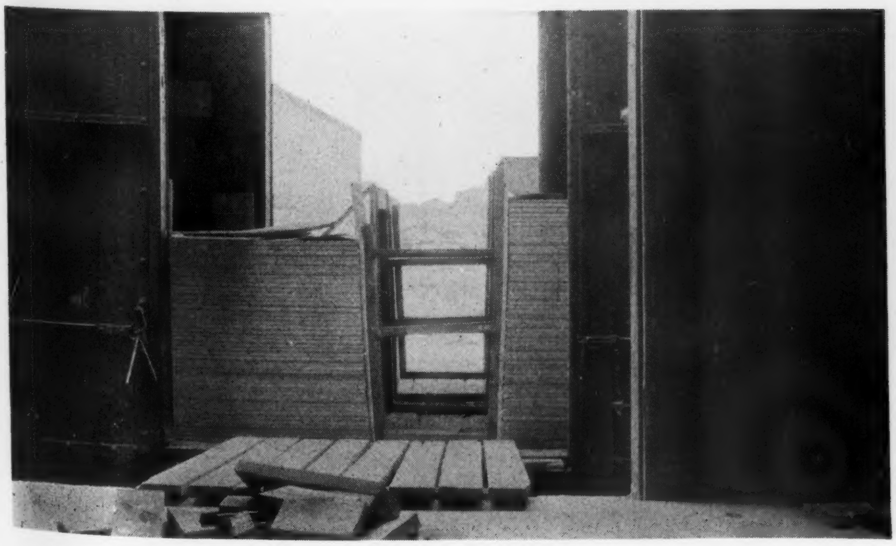
The National Gypsum Co. was organized under the laws of Delaware on August 29, 1925. The authorized initial capital is $2,500,000. Besides the plant described the company intends to build plants in other gypsum fields, according to popular reports.

Stockroom showing board ready for shipment—note the method of piling board on elevated platforms under which the storage-battery truck is placed



Drives on lower half of wall-board machine (left) and on wall-board "shifter" to dryer

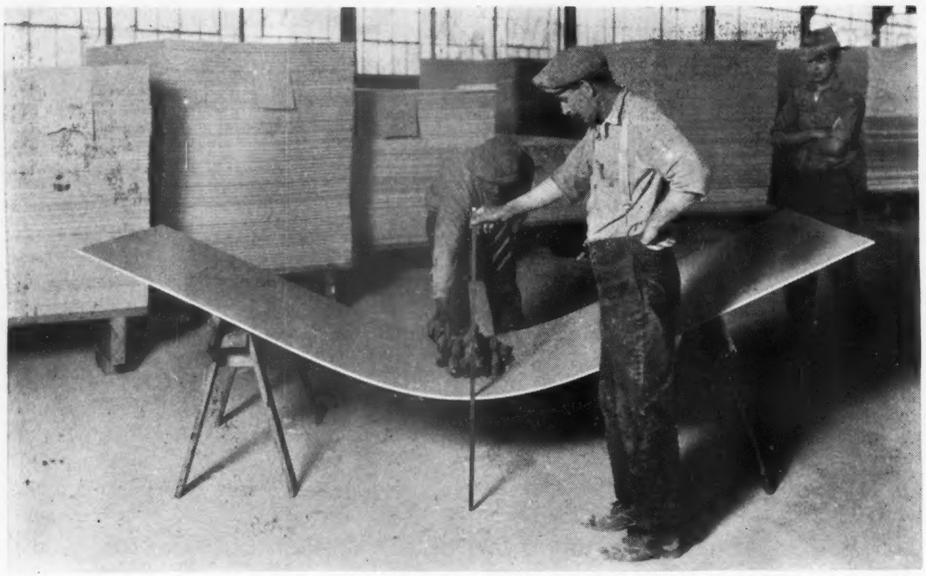
Bagging machine in the wall-board building is the only provision for shipping plaster or stucco



Method of packing board in box cars

A recent report in the Detroit (Mich.) *News* states that the National Gypsum Co. has completed the purchase of about 4000 acres of land, just south of Emery Junction, and will start at once, the opening of quarries and the construction of a plant for the manufacture of wall board, plaster and other gypsum products. The plant, which it is said will be among the largest of its kind in the country, will involve an investment of over half a million dollars.

A recent circular letter of the company, signed by M. H. Baker, as secretary, states: "Our organization has developed a new process protected by patent application through which we are manufacturing a superior product at comparatively low cost. National plaster board is now in the hands of leading dealers throughout the East. The capacity of the mill is over-sold and the management



Showing remarkable strength and elasticity of new National wall-board

has good reason to feel that National plaster board will ultimately revolutionize the wall-board market."

The new wall board is being extensively handled by lumber dealers, as well as masonry building-supply dealers.

Progress in Waterproofing Gypsum

ABOUT three and one-half years ago the bureau initiated an investigation of methods of increasing the weather resistance of gypsum. A detailed report was published in the *Technical News Bulletin* of February 10, 1925 (mimeographed). Since that report was published a number of changes have been noted in the cylinders and panels exposed, and the results seem to justify a progress report at this time.

As stated in the previous report, three general methods were used:

The first method, that of covering the set material with a waterproof coating, has given some fair results with certain compounds. Paraffin, stearic acid, beeswax dissolved in benzol, commarone resin and certain waterproof coatings obtained from the open market have all proven fairly satisfactory. However, other waterproof coatings, such as tung oil varnish, bituminous paint, cromate paint, cellulose acetate, fish and hide glues, hot beeswax and certain waterproof coatings obtained from the open market have failed to show promise of increasing the weather resistance of gypsum.

The second method, that of precipitating on the surface an insoluble compound formed by the reaction of some material with the gypsum, has so far proven quite successful. Barium hydroxide, sodium silicate and barium hydroxide, used in combination with silicic acid, have proven to be quite successful materials for increasing the weather resistance of gypsum. However, the use of alum as a material for weatherproofing gypsum by this method has not given results.

The third method, by the addition of an integral waterproofing compound to the gypsum, also seems to offer possibilities for the weatherproofing of gypsum quite successfully. Blood albumin glue, hydrated dolomitic lime and several compounds obtained from the open market have so far given very promising results. However, talc, veneer glue, ammonium borate and several other integral waterproofing compounds have not proven at all successful.

Another method, that of casting heat gypsum under pressure, indicates favorable re-results. The dense gypsum cylinders have resisted the weather quite successfully for approximately two and one-half years without appreciable deterioration.

At present there are approximately 150 treated cylinders and 32 treated panels being exposed to the weather. Examination of these cylinders and panels is made from time to time. As new methods of treatment or new compounds come to the bureau's attention cylinders are made and exposed for observation.—*Technical News Bulletin of Bureau of Standards.*

Further Data on Regenerator Lime Kiln

IN the article entitled "Some Modern European Types of Gas-Fired Lime Kilns" published in the August 21 issue, a brief description was given of a regenerator kiln designed by F. Crosland, Cheshire, England. To supplement the information given, Mr. Crosland has written us the following:

"This kiln requires a chimney to create the draught, and a lever is placed on the kiln top to stop the heat from going out there instead of across the kiln.

"The kiln need not be more than 25 to 30 ft. high if intended for calcining soft stone or chalk, which if much pressure is put on it will not stand it, but crumble away in the kiln.

"This kiln could also be used with oil firing by making some alterations in the firing, and the regeneration principle would save a large part of the oil. As all the fuel required would be to keep the heat up, a good proportion would be obtained from the regenerator chambers.

"It may also be interesting to your readers to learn that I have had my oval kiln, described in the same issue, running on 400 cwt. of fuel per ton of lime produced.

"These particulars may elucidate the matter and I shall be obliged if you will insert them in your next edition."

The personnel of the National Gypsum Co.'s Clarence, N. Y., plant

Quarrying Tennessee Marble

Tennessee Marble and Brick Co. Produces Vari-Colored Aggregate as a By-Product

THE Tennessee Marble and Brick Co., Fayetteville, Tenn., has been recently organized with a capital of $125,000 and is taking over all the property of the National Marble Co. and the Lincoln Marble Co. The company has 143 acres of land near Brighton, Tenn., which contains a large amount of colored marble. According to R. W. Gaunt, secretary-treasurer of the company, 40 acres of this land have been surveyed by three different geologists and in this they are said to have found seven different colored marbles with an estimated total of 163,990,000 cu. ft. This is divided as follows:

American cream and American pearl (Tennessee pink, light and dark), 18,850,000 cu. ft.; Autumn Glory (bronze or dark pink), 22,950,000 cu. ft.; American Belgian black, 42,750,000 cu. ft.; Topaz Grey, 18,510,000 cu. ft.; Bird's Eye Antique, 13,140,000 cu. ft.; French horizon blue, 40,370,000 cu. ft.

General view of quarry and crushing plant

The marble is located on both sides of a canyon, on the bottom of which the railroad runs.

At the present time the company is engaged in stripping the quarry and crushing the poorer quality and small pieces of marble into stucco, dash, terrazzo and concrete meal. It is further planned to establish a brick and tile plant to manufacture the full marble brick from the meal or dust screened out. Through these means the by-products of the cut marble production will be disposed of in an economical and profitable manner.

It is expected that the quarrying operations will soon be far enough advanced in the deposit to start sawing out large blocks of solid marble. The plant is equipped to manufacture nearly all types of finished marble products. At present its marketing is limited to marble chips, which is carried on through the Central Commercial Co. of Chicago.

George A. Jarvis is the president of the Tennessee Marble and Brick Co. and R. W. Gaunt secretary-treasurer. The office is at present near the plant at Fayetteville, Tenn.

Blue Trap Quarry To Be Reopened

CONSTRUCTION of a modern rock crushing plant on the site known as the Blue Trap quarry, located on the Rock Island railroad within the switching limits of Little Rock, Ark., will be started immediately and is expected to be completed by January 1. The lease for the property was signed by J. W. Carmeau of Carruthersville, Mo., and is for 25 years with a provision for renewal from the Saline Bauxite Co. of Little Rock. The property was acquired by the local company about a year ago, but never has been operated, according to W. D. Cammack, president of the Saline Bauxite Co.

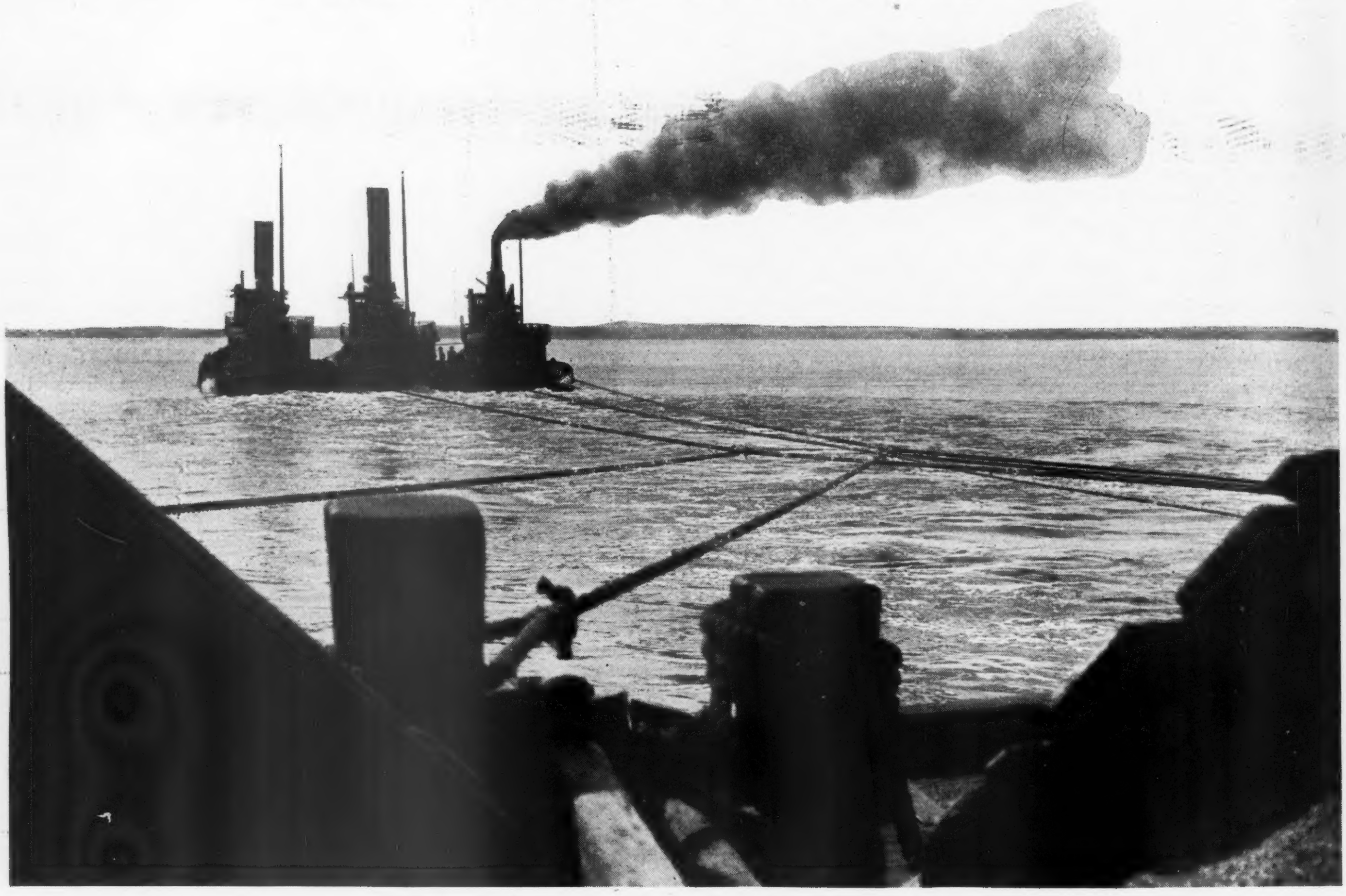
The plant was built some years ago, and as the machinery is not modern it will be replaced with new equipment. Frank Carmeau, a brother of the purchaser, will supervise the replacement. The quarry has been opened about 100 ft. and switching tracks to accommodate about 20 cars are in place. When in operation, the plant will employ 50 to 75 men.—*Little Rock (Ark.) Gazette.*

Opening up a ledge of pink marble

Loading marble chips at the plant

Sand and Gravel for New York City

Operations of the Goodwin-Gallagher Sand and Gravel Co. at Port Washington, Long Island, Have Interesting Details



Towing a group of sand and gravel barges from the north shore of Long Island to the New York City metropolitan district

TO attempt to describe in detail the business of supplying New York City and the metropolitan area with sand and gravel would require a book. Most of the operations for producing the material are notable for their size, and some of them have particularly interesting and unusual details. One of these is the Gallagher plant of the Goodwin-Gallagher Sand and Gravel Co. near Port Washington, L. I. This company is one of the oldest producers in the metropolitan district, and the operation described is their original operation, rebuilt and enlarged, of course, to meet present needs. The company now has other plants and is one of the largest, if not the largest, producer of sand and gravel in the world, their annual output amounting to about 3,000,000 cu. yd. per year. This is nearly 25% of the entire production of New York State.

The excavating is a dry operation—kept dry by a dike of waste material between the worked-out flooded part of the pit and the part being worked. This is an unusual fea-

Diking the waste water pond with pea gravel—a waste product to a considerable extent

Steam shovel working in gravel bank behind the dike separating the waste water pond

General view of the plant from the pit—upper level at the right

ture that we do not recall having seen in pit operation before.

The deposit is of immense acreage and depth, as the views herewith show, and two fairly distinct kinds of material are dug on the two levels shown.

The upper level produces fine sand and gravel that has to be washed, the lower level produces a clean coarse sand in abundance, that is prepared by dry screening. Three 90-ton railroad type steam shovels do the excavating, and 30-yd. special steel, bottom dump cars, hauled by 20 and 25-ton saddle-tank steam locomotives, do the hauling. The tracks are 3-ft. gage. The dike between the bank and the waste-water pond is built by a locomotive crane and clamshell.

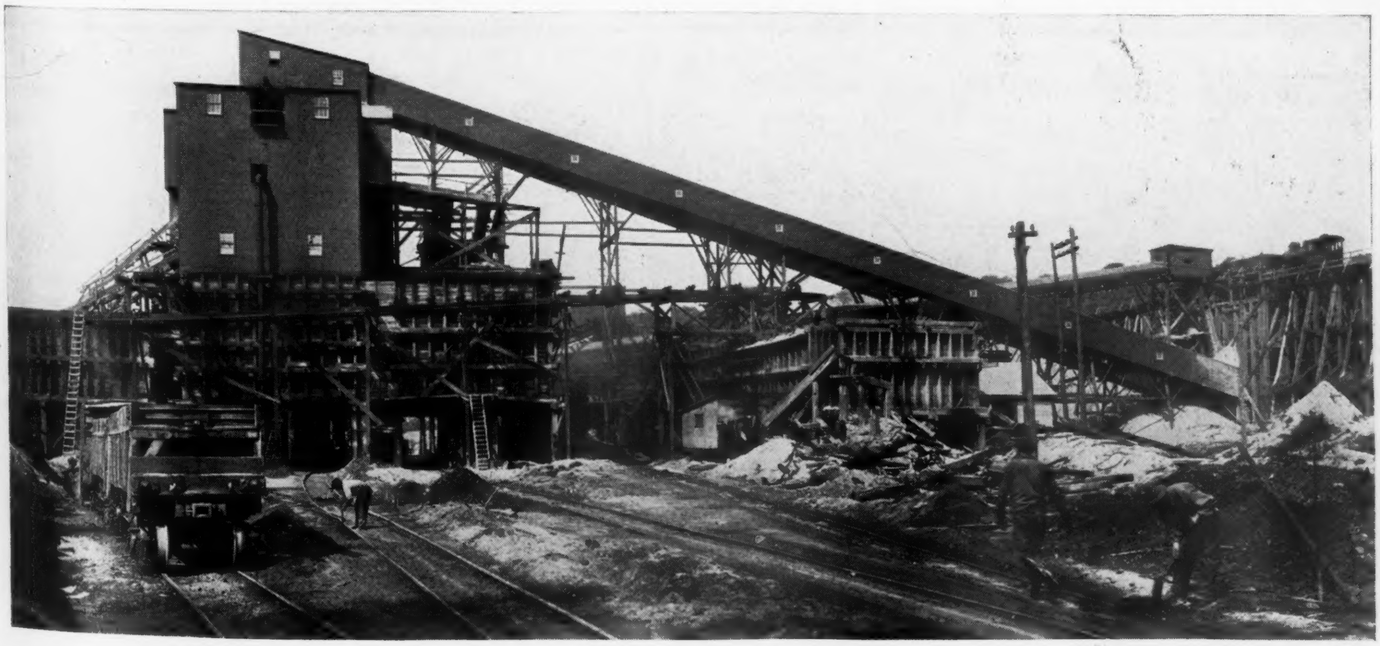
There are really two distinct plants, one fed by material from the upper level, and one from the lower level. The material from the upper level is fed through hoppers with grizzlies to a pair of 36-in. belt conveyors, which discharge to scalping screens in the top of the screening and washing plant. The oversize goes through a primary crusher before being fed to the belt conveyor as 2½-in. size.

The material from the lower level is fed through inclined grizzlies to five 36-in. belt conveyors leading to a battery of inclined gravity screens, where the material is screened dry to make concrete sand. Other belt conveyors provide for transferring this material to the washing and screening plant when desired. The bins for holding the dry-screened sand are directly under the inclined gravity screens and this material ordinarily needs no other preparation to be used as concrete fine aggregate.

The washing and screening plant is unusual only in size. After passing a scalping screen (removing everything under 1½-in.) the material goes through a battery of trunnion screens, arranged in pairs on each side of an inclined runway, there being four steps in the screening process. There are eight screens on each side of the runway or 16 in all. The screens are belt-driven through bevel gears.

The finished gravel (1½-in. and less) goes to bins beneath the screens and the sand to a series of settling tanks at one side of the gravel bins. The sand tanks are the hand-operated, valve-bottom type.

The oversize material (2½ to 1½-in.) from the scalping screen is chuted to two Buchanan roll crushers, one 42x16 in., and



General view of Gallagher plant from the tracks which lead to the wharves

Grizzly on lower level dumping tracks

Another view of the grizzly from the rear

the other 64x24 in. The larger roll takes the material over 2¼-in., and the small the 1½ to 2¼-in. sizes.

Experience with Roll Crusher

As this is one of few installations of roll crushers for gravel crushing, the roll crusher manufacturer was particularly interested in getting the experience with them. With the cooperation of the gravel company a thorough survey and analysis of costs was made with the following results:

The smaller roll crusher was being operated 9 to 10 hours a day six days a week, with the exception of a few weeks during the winter months. From 400 to 500 tons of gravel pass through the crusher in a 9-hr. day.

At the time of the test, on account of the worn condition of the tires, the setting was 1⅛ in. However, with a setting of ¾ in. no trouble was experienced crushing the gravel, even though it is particularly hard.

The gravel is quite cubical in shape as it comes from the roll crusher. There is very little slabby material. Two samples of the crushed gravel from the 42x16-in. machine which were taken an hour apart and tested by means of a rocking sieve with square openings of exact dimensions, showed the following percentages of different sizes:

	Sample No. 1	Sample No. 2	Av. of 2 samples
Percentage remaining on 1½-in. screen	4.1	8.9	6.5
Percentage remaining on 1-in. screen	37.0	56.2	46.6
Percentage remaining on ¾-in. screen	21.0	16.6	18.8
Percentage remaining on ½-in. screen	19.4	12.4	15.9
Percentage remaining on ¼-in. screen	11.9	4.7	8.3
Percentage passing thru ¼-in. screen	6.6	1.2	3.9
	100.0	100.0	100.0

Birds-eye view of the Gallagher plant of the Goodwin-Gallagher Sand and Gravel Co.

The part of sample No. 2 which passed through the ¼-in. screen was shaken on a No. 8 Howard Morse sieve (8 meshes per in.); 49% remained on the sieve.

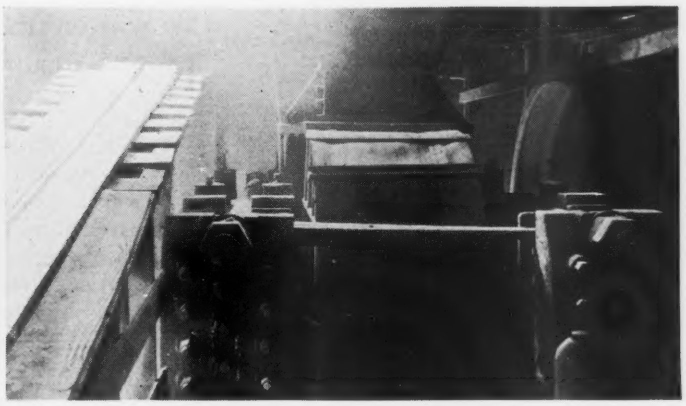
Average Power Consumption of Crusher 16.14 Kw.

The roll crusher is driven at 95 r.p.m. by a 50-hp. alternating current induction motor by means of a 12-in. belt. The motor runs at 850 r.p.m. when fully loaded. When the normal amount of gravel is going through the roll crusher the motor is not up to full load.

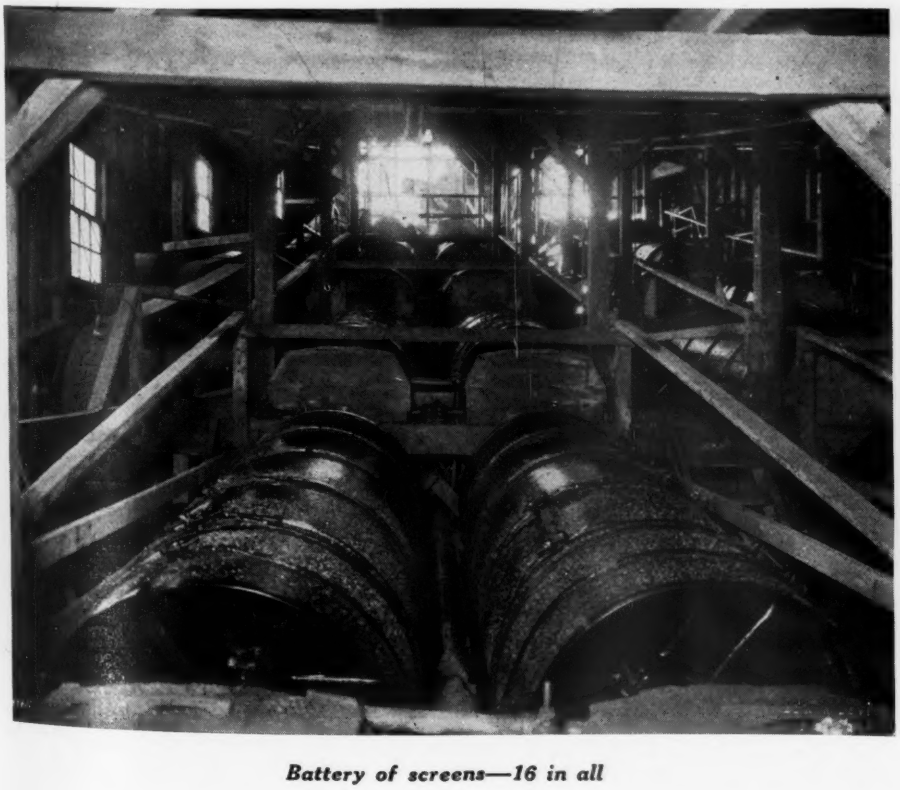
On October 8, 1925, power tests were made on this roll crusher by a representative of the Long Island Lighting & Power Co. and a representative of the A. C. Nielsen Co. The power consumption under varying load conditions was determined by means of a polyphase graphic watt meter, and an indicating watt meter was used to check the results.

Gravity screens for dry material from lower level

Close-up of gravity screen



One of the crushing rolls for gravel



Battery of screens—16 in all

The rate of feeding gravel to the roll crusher was calculated by discharging the gravel into a long trough and noting the time required to fill a certain number of cubic feet. The attached sheet shows graphically the results of this test.

On the day the test was made the amount of stone passing through the roll crusher was slightly below the normal rate of production. From the data obtained, however, the power consumption for the average output of 50 tons per hour was determined as 16.14 kw.

Crushing Cost for Hard Gravel Was $0.0361 Per Ton

The cost of crushing the gravel, as shown in detail in the attached tabulation, is $0.0361 per ton or $0.0488 per cu. yd. These costs include depreciation, interest, repairs, power, the labor of the operator, and the cost of the lubricant, but do not include overhead expenses. The average daily cost is $16.24 on the basis of 285 working days per year, which is about the average length of the operating season in this locality, although the material moves to some extent all winter.

Cost Analysis

Depreciaticn—\$6,025.00 × 10%		\$ 602.50
*Average interest at 6%— $\frac{11}{10} \times \frac{\$6,025.00 \times .06}{2}$		198.83
Maintenance and repair costs per year:		
Replacing tires every 9 months, average:		
Cost of tires....\$370×12/9	\$493.33	
Labor:		
150 hr. at \$0.50 per hr.	75.00	
18 hr. at 1.00 per hr.	18.00	
	\$586.33	
Replacing hopper every year:		
Cost \$96.00		
2½ hr. at 50c per hr. 1.25		
Labor:		
	97.25	
Replacing steel plates in hopper every 6 months:		
Cost—\$45.00 × 2.........\$90.00		
Labor:		
4 hr. at 50c per hr..... 2.00		
	92.00	
Misc. repairs—springs, bolts, etc.	40.00	
Total repairs		815.58
Grease—No. 3: 22 lb. per wk. × 48 wk. × 7c per lb.		73.92
Total fixed costs per year		\$1,690.83
Total fixed costs per average day: \$1,690.83 ÷ 285 days		5.93
Power cost for the average tonnage: 16.14 kw. × 9 hr. × 4c per kw.h.		5.81
Labor cost: 9 hr. at 50c		4.50
Total cost per average day (excluding overhead expenses)		\$ 16.24
Crushing cost per ton of stone: \$16.24 ÷ 450		.0361
Crushing cost per average cu. yd.: \$16.24 ÷ 333		.0488

*Allowing for interest earned by depreciation reserve.

The general offices of the Goodwin-Gallagher Sand and Gravel Corp. are at 21 E. 40th St., New York City. H. Dupuy, of Pittsburgh, Penn., is president; J. J. Gallagher is vice-president and general manager; J. V. Gallagher, secretary; F. F. Gallagher, treasurer, and R. G. Waller is superintendent of the Gallagher plant.

Service and Its Abuse

A MINE CAR manufacturer recently complained of a practice that he said was all too prevalent. A certain mining company, for example, needs cars of a special design perhaps to meet peculiar operating conditions. It naturally makes known its wants to several competitive manufacturers. Whereupon these put their engineers to work, and ultimately each of them, after spending considerable time and money, submits to the prospective customer his solution of the problem, expressed in detailed drawings accompanied by an estimate. Does any one of the competitors land the order? At times. But all too frequently, it is alleged, what happens is this: the mining compan yrejects all bids, and having the advice and drawings of several manufacturers, all entirely gratis, proceeds to make its own cars. Or, instead of doing this, the company, from the half dozen or so sets of drawings furnished by the competitors, prepares a composite design embodying the best ideas submitted, and on it seeks bids, perhaps fro mmanufacturers who have hitherto contributed nothing.

Such practice in placing orders for new equipment is without doubt questionable. It is hardly fair. It is made easy by the highly competitive conditions that exist in certain lines. It is the result of the free giving of service that is so marked a characteristic of the manufacturing world today. What is the answer—the remedy? There seems to be none—save to say that the Golden Rule is not yet an obsolete "gag" to all, and that its observance by companies is as desirable as by individuals. The doctrine "live and let live" may be anathema among competitors, but the mine operator is not a competitor of the manufacturer. Instead, he needs the manufacturer, perhaps more than he realizes, and almost as much as the manufacturer needs him.—An editorial in *Engineering and Mining Journal-Press.*

Show How Limestone Benefits the Soil

THE benefits of the treatment of the soil with limestone for agricultural purposes was shown in a very interesting and convincing way at the State Fair this year. There were exhibits by the soils division of Ohio State University, the National Agstone Association and several individual producers of limestone.

The various grades of limestone were shown and information was furnished as to the merits of each in the treatment of certain soils and their relations to the crops grown upon them.

Slides and pictures revealed the important part that limestone plays in the raising of such crops as corn, hay, clover, wheat, etc., and also showed how essential the use of limestone is even in the production of wool, eggs, milk, pork, beef, etc. Limestone, it was shown, must be taken into the systems of cattle and poultry if they, in turn, are to produce food of the highest value.

There was displayed in one exhibit, also, a miniature farm, with specimens of soil which had been treated with limestone and which had not been so treated. That crops grown on soil to which limestone had been applied were larger and richer was proved by various demonstrations. Limestone corrects the sour acid condition of the soil and restores the soil's fertility. Naturally, the amount of limestone required per acre depends on the condition of the soil and the nature of the crop.

Limestone, it is stated, makes two dollars grow where one grew before. The following table has been prepared to show the actual increase in crops when limestone has been used:

	Yield per Acre	
Crop	Before Lime	After Lime
Mammoth clover	3566 lb.	5063 lb.
Clover hay	716 lb.	2680 lb.
Alfalfa	1940 lb.	2780 lb.
Soy bean hay	4480 lb.	6368 lb.
Wheat	22.5 bu.	31.4 bu.
Corn	30.7 bu.	43.4 bu.
Cotton	592 lb.	800 lb.
Cow peas	1800 lb.	2800 lb.
Velvet bean hay	4112 lb.	5184 lb.

Members of the National Agstone Association, which joined in the exhibit held under the auspices of this organization, are:

The Marble Cliff Quarries Co., Columbus, O.

Casparis Stone Co., Columbus, O.

Colgan Limestone Co., Columbus, Ohio.

Columbia Quarry Co., St. Louis, Mo.

Grove City Limestone Co., Sharon, Penn.

New Castle Lime & Stone Co., New Castle, Penn.

Ohio Marble Co., Piqua, O.

Reinhold & Co., Pittsburgh, Penn.

Carbon Limestone Co., Youngstown, O.

Columbus Products Co., Cleveland, O.

American Limestone Co., Knoxville, Tenn.

Franklin Limestone Co., Nashville, Tenn.

Kittaning Limestone Co., Kittaning, Penn.

Wisconsin Co-operative Agstone Assn., Madison, Wis.

Wallace Stone Co., Bay Port, Mich.

France Stone Co., Toledo, O.

Canada Crushed Stone Corp., Hamilton, Ont.

The Kelly Island Lime & Transport Co., Cleveland, O.

There was much interest on the part of fair visitors also in a model railroad track which had been put in by the New York Central Lines. This track consisted of 120-lb. rails and was ballasted with crushed stone.—*Better Highways,* published by the Ohio Crushed Stone Association.

Office and storehouse of the Gallagher plant of the Goodwin-Gallagher Sand and Gravel Co.

AGRICULTURAL limestone producers from the states of New York, Pennsylvania and Ohio met in Buffalo, N. Y., Thursday, September 30, for co-ordinating promotional work. A complete report of the meeting will be published in the October 16 issue of ROCK PRODUCTS.

Effect of Voids in Aggregate

IN a paper presented before the Pacific Coast Rock and Gravel Association, C. L. McKesson, of the California Highway Department gave the results of a study of voids in aggregate that emphasizes the importance of grading to reduce voids. In one table he shows that the cost of concrete may be reduced from \$9.28 to \$7.54 (a saving of 23%) by decreasing voids in aggregate through close grading so that a lesser amount of cement will be required for the same strength.

The figure (reproduced from the *National Sand and Gravel Bulletin*) shows the aggregate in three concrete mixtures. The first specimen has aggregate with 45% voids in both sand and rock, the second with 45% voids in the sand and 35% voids in the rock, and the third with 35% voids in both sand and rock. It is plainly seen from the sections that much more cement will be required to cement the particles together in No. 1 than in Nos. 2 and 3.

TABLE I—COST OF MATERIALS

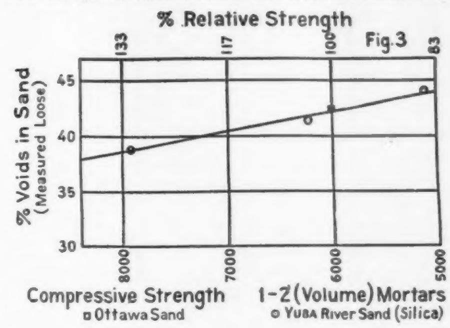
Cement, \$3.00 per bbl.; sand, \$2.00 per ton; rock, \$2.40 per ton

Material	Concrete No. 1	No. 2	No. 3
Cement	\$5.47	\$4.20	\$3.48
Sand	1.19	0.91	1.07
Rock	2.62	3.09	2.99
Total per cu. yd. concrete	9.28	8.20	7.54
Per mile of pavement, 2,300 cu. yd.	\$21,344.00	\$18,860.00	\$17,342.00

High voids in natural sand means an excess of fine sand, which means a greater surface area to be covered with cement. The fine sand used in No. 1 demands a 1 to 1⅛ mortar to secure the strength needed. The difference is strikingly shown by the strength if equal amounts of cement are used with all three aggregates. No. 1 will have a strength of 2800 lb. per square inch and No. 3 will have a strength of 4800 lb. per square inch.

Since concrete may be considered as made up of pieces of coarse aggregate held together by a cement sand mortar, the strength of mortar is all-important. Mr. McKesson's paper shows the effect of voids on mortar strength as determined at the California highway laboratory. The sand used was a natural sand consisting almost entirely of water-worn particles of silica. Variation from 44% of voids to 38% of voids increased the mortar strength (in comparison) nearly 3000 lb. per square inch, as shown in the graph. In the concrete Mr. McKisson claims this would mean an increase of at least 1000 lb. in strength.

EFFECT OF VOIDAGE IN SAND ON MORTAR STRENGTHS



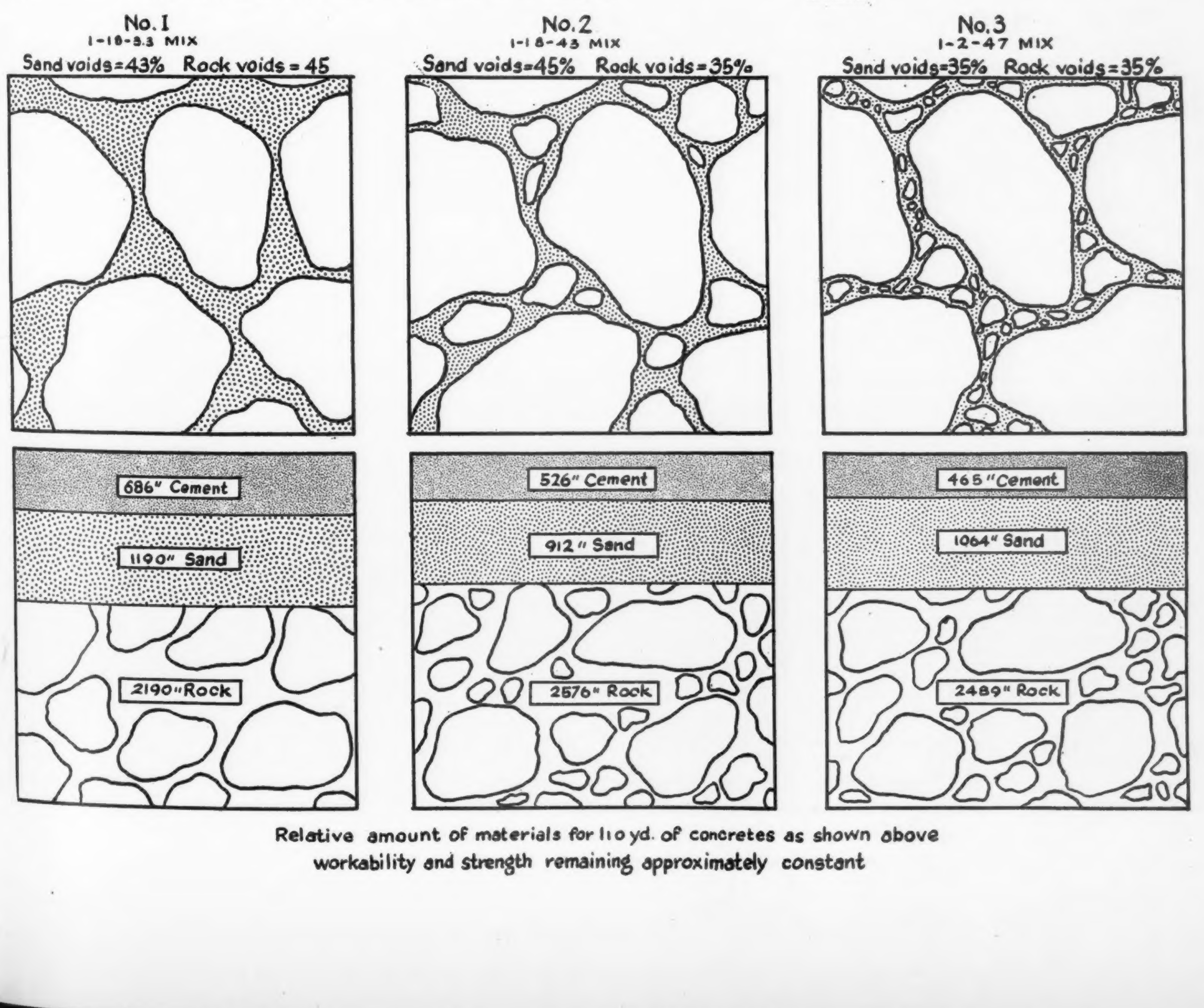
The cost of materials for concrete made of the aggregates shown in the illustration is given in Table I. In Table II the quantity of materials required is specified. These tables are for concrete of equal strength and it will be noted that the greatest variation is shown in the amount of cement—the most expensive material—that is required.

TABLE II—QUANTITY OF MATERIAL

Tons Per Mile of Pavement (2300 cu. yd.)

Material	Concrete No. 1	No. 2	No. 3
Cement	780	605	534
Sand	1350	1050	1223
Rock	2490	2965	2862
Rock and sand combined	3840	4015	4085

Note: This table assumes that concrete of equal density can be obtained. It is difficult to secure a high degree of density with poorly graded material as used in No. 1 concrete. With lower density the quantity of material used would be slightly less and material would be replaced by air voids in concrete.



Relative amount of materials for 1 cu yd. of concretes as shown above workability and strength remaining approximately constant

Laboratory Control of Aggregate In Michigan*

THE quantity of aggregates used by the Michigan state highway department is much greater than that of any other material, as they form nearly 90% of the concrete bridges and culverts, and the concrete and bituminous pavements, and 100% of the gravel roads. During the year 1925 the department used approximately 24,000 carloads of aggregates in concrete bridges, culverts and pavements, 1700 carloads in bituminous pavements, and 13,000 carloads in gravel roads, or altogether a total of 38,700 carloads.

The specifications are frequently taken more or less for granted by the less experienced field men, without much attempt to analyze the reasons for the various provisions, and as a result it is sometimes difficult to form a sound judgment as to whether certain materials on the border line should be accepted or rejected. In fact, if the young engineer attempts to find a book which will interpret aggregate specifications, he will search in vain, and it is the lack of available information on this subject which seems to justify a brief discussion of some points which may be entirely familiar to the majority of engineers.

When it comes to the grading of aggregates, there is enough difference of opinion among experts to cause anyone to hesitate before making certain dogmatic statements, but there are certain things which are generally accepted as facts. One is that with given proportions of cement, water and sand, coarse sand will make stronger mortar than fine sand. Hence the specification that not more than 95% shall pass a 10-mesh sieve. On the other hand, it is sand that we want for fine aggregate and not gravel, so we say that at least 95% must pass a ¼-in. screen, while the 20-mesh and minimum 10-mesh requirements are added to give a uniform grading and low void content, thus presumably increasing the strength of the mortar. If the sand does not contain at least 5% of particles passing a 50-mesh sieve, the concrete will not finish easily and this requirement would be raised to 10% if such sand could be generally obtained.

"The proof of the pudding is in the eating," and therefore we say that when tested in comparison with standard Ottawa sand, which is of uniform size (20 to 30 mesh), mortar made with the sample sand shall be at least as strong as that made with the standard sand. Tensile rather than compressive strength is tested in this case, because the former test is more easily made, the results are more consistent, and the compressive strength varies approximately as the tensile strength.

Much that has been said regarding fine aggregates applies also to coarse aggregates. Thin or elongated pieces are more easily named than defined, and it is doubtful if their exact effect upon concrete is known, but they are apt to break easily and form excessive voids, so that they are believed to be harmful. Few aggregates are entirely free from such material, and the percentage which warrants rejection is a matter of opinion.

As nearly all gravel deposits in Michigan contain more or less soft sandstone, keel (clay ironstone), and similar materials, it is practically impossible to eliminate them entirely, and this situation is recognized to the extent of permitting as much as 2% or 3% by weight. The exact effect of this material is not known as yet, but the laboratory is now making a series of tests of concrete specimens containing varying amounts of soft stone. It is believed that excessive amounts of such material decrease the strength and wearing qualities of concrete, at least indirectly, by requiring more water to produce a given slump, and the extra water is harmful. Soft stone tends to "float" to the surface as the concrete is placed, and it is then liable to be disintegrated by frost and traffic. Pieces of shale in the surface are knocked out by traffic and leave pits. These pits frequently have a small amount of shale left in them which clearly indicates their origin.

Increasing the maximum size of the coarse aggregate increases the strength of the concrete so long as the material can be handled easily in the work. Therefore, a maximum size up to 2½ in. is permitted and at least 25% must be retained on the 1-in. screen. The 13% allowed to pass the ¼-in. screen is merely a tolerance, which would be eliminated if practicable. The use of unscreened aggregates is not permitted because of the difficulty of keeping the proper ratio between the fine and coarse aggregates as furnished and the danger of segregation of sizes in handling.

The laboratory places inspectors at aggregate plants when the quantity furnished the state amounts to as much as ten cars a day, but it is sometimes necessary for the engineers to reject aggregates on the job which have been passed by the plant inspectors. This practice has been frequently referred to by contractors and aggregate producers as "double inspection" and has been strenuously objected to by them. Such objections to so-called "double inspection" are, however, based upon a misunderstanding.

In the first place, the specifications form a part of the agreement with the contractor and cover the materials at the time they are placed in the mixer. It would be entirely logical under the contract to have all inspection performed on the job, even right at the mixer skip, all unsatisfactory material being rejected at the last moment only. This, however, would involve a great expense in freight and handling charges on rejected material and frequent annoying delays to the work. To reduce such expense and delays to a minimum, the state places the inspectors at the plant to stop unsatisfactory aggregates at the source. In other words, the inspection is essentially at the job, but a man is put at the plant to keep poor material off the job.

As a matter of fact, there is very little material which has to be rejected on the job after it passes the plant inspector, but it is extremely doubtful if plant inspection of aggregates can ever be made 100% perfect. In the case of such materials as cement and steel, samples can be taken in a specified manner from each car and every sample can be tested, so that when a car is once approved there is no reason for subsequent rejection, except possible deterioration from some cause after shipment.

Unfortunately, however, aggregates are not susceptible to such exact plant inspection methods. As an extreme case, there is one plant which has a capacity of about 200 cars daily. This would be an average of a car every 7 minutes during a 24-hour day, if shipments were at a uniform rate, and with a much smaller daily output the rate of loading may be as fast, or even considerably faster, for a few hours a day. As it takes at least 10 minutes to sample a car properly, and nearly 2 hours to make a complete test of a sample, it is absurd under such conditions to say that an inspector's card on a car should be considered as a guarantee of quality and that all further inspection should be eliminated. What actually happens is that one inspector watches the car as it is filled and if it looks all right he signals another inspector, who tacks on a card. Five minutes later the car may be half a mile down the track and 30 minutes later it may be on the main line headed for the job. In some other cases, aggregates are loaded and shipped at night, which of course makes plant inspection still more difficult.

The method used by our laboratory in sampling cars is to dig "shoulders" on about six or seven of the "waves" formed by the movement of the car in loading. About three of these shoulders are usually dug in the center of the waves and the other four about half way between the center line and the side of the car, half of them being located on each side of the center line. Samples are then taken by digging into each shoulder, and these samples are placed upon a piece of canvas. After thorough mixing, the combined sample is quartered, if necessary, to get a single sample of the proper size. Some additional digging should be done to detect the possible presence of sand cores at some distance below the surface.

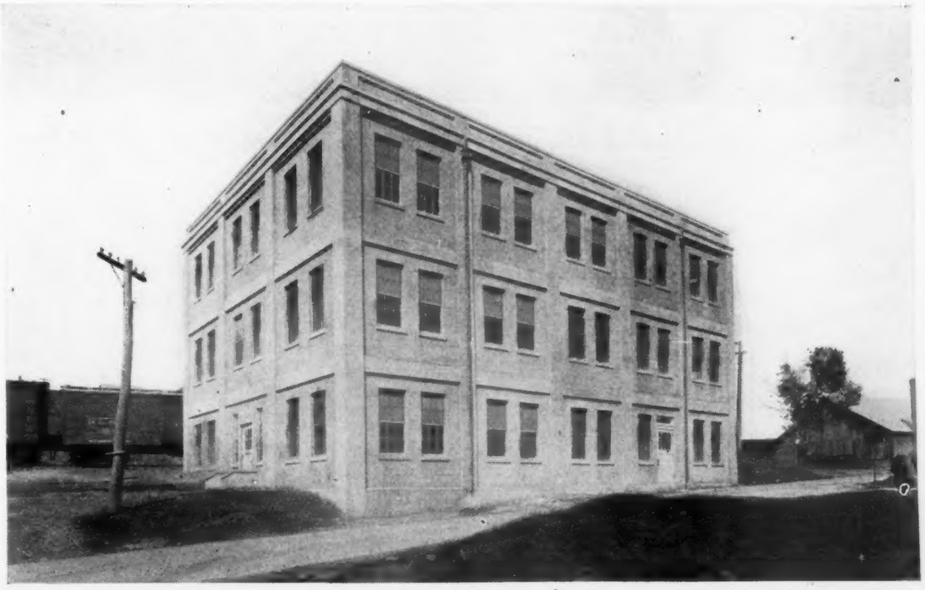
*From a paper by Roger L. Morrison, associate professor of highway engineering at the University of Michigan and director of the Michigan State Highway Laboratory at the University's annual conference on highway engineering.

Nazareth Cement Co.'s New Laboratory

A Large Building Equipped to Test Cement and Materials According to Latest Accepted Methods

By Edward E. Dreisbach
Head of Research Dept., Nazareth Cement Co.

THE new laboratory of the Nazareth Cement Co., located at Nazareth, Penn., about seven miles northwest of Easton, is conceded to be among the most modern and most completely equipped in the cement industry. The building is a 3-story structure, 70 ft. long, 50 ft. deep at west side and 20 ft. at east side. The exterior walls are of reinforced concrete, and the interior partitions are in part of reinforced concrete and in part of steel and glass. The building is fireproof throughout and steam heated by a central heating plant set apart from the main structure. This also supplies heat to other buildings on the premises. The building was designed to have plenty of light and ventilation, features highly necessary for work of the kind for which this building is intended. To insure an atmosphere free from fumes and vapors, two hoods, patterned after the well known Cornell University type, are provided where chemical procedure is to be carried on.

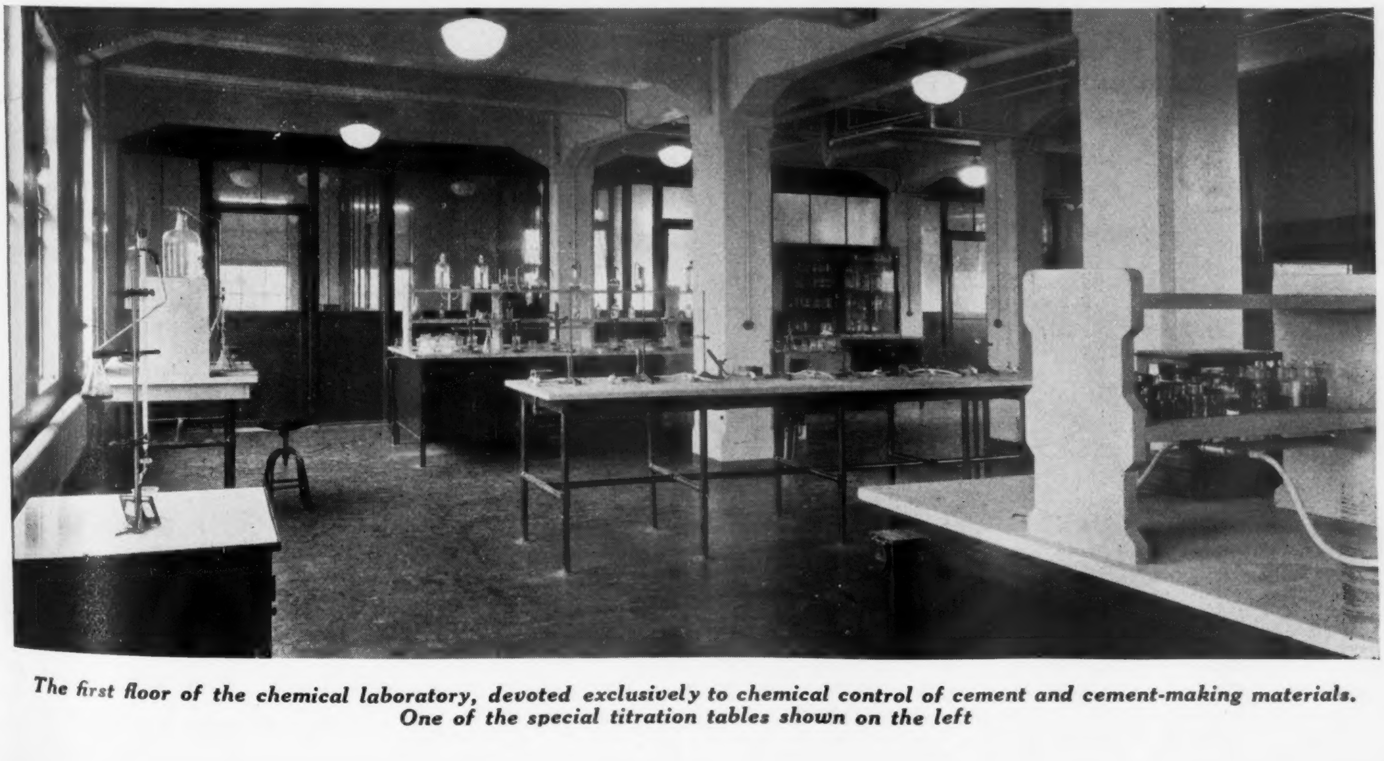


The new laboratory, conceded to be one of the most modern in the cement industry

The ground floor is designed for the physical testing of cement, cement products and materials allied to the manufacture and use of cement. The ground floor contains one large testing room, an office, a locker room, a grinding, pulverizing and crushing department, and a storage room. A Sedgwick dumb-waiter of 150 lb. capacity is built in and travels from the ground floor to the second floor.

The furnishings, including tables, storage tanks, vats, moist closets, lockers, cabinets and desks throughout the entire laboratory, are made of steel, slate and "Alberene" stone. The furniture for the most part was designed by the company's chemists to meet special needs, and many pieces are considered unique.

The building is



The first floor of the chemical laboratory, devoted exclusively to chemical control of cement and cement-making materials. One of the special titration tables shown on the left

A general view of the laboratory where special attention is given to problems of production and service relative to cement and cement products

wired and electrically equipped throughout, so that as much work as is possible and practical may be done by electricity. To this end a full complement of electric muffle furnaces, hot plates, water baths, water stills and boiling tanks has been installed. The water still of the Barnstead type is electrically operated and has a capacity of two gallons per hour. In addition to the electrical equipment, the laboratory has an adequate supply of city main gas and gas appliances for use where heat is required.

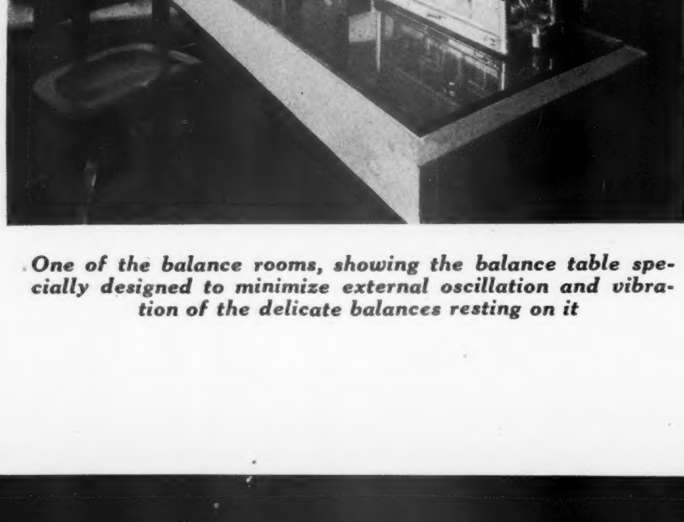
The physical laboratory is equipped with a 200,000-lb. Riehle compression machine, two 1000-lb. Fairbanks and one 1000-lb. Tinius Olsen tensile testing machines of approved types.

The crushing, grinding and pulverizing department is equipped with a Braun jaw crusher, a disc pulverizer and an Abbe ball mill of about 100-lb. capacity, each independently motor driven. Future plans include the installation of several smaller Abbe porcelain jar mills.

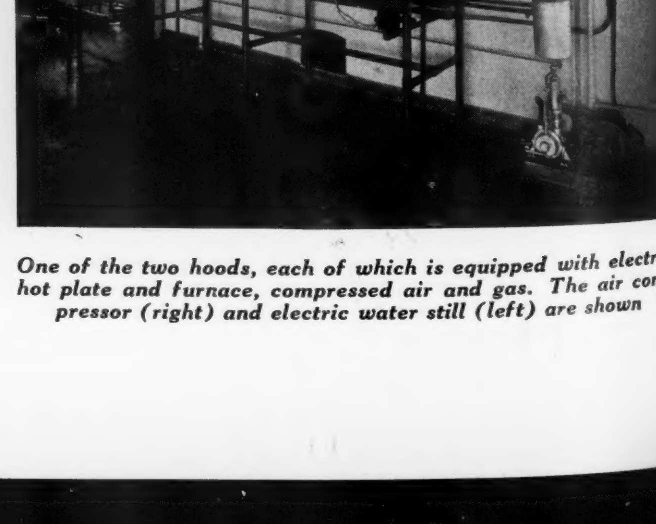
Thermometers and instruments for indicating temperatures and measuring atmospheric humidity have been installed, so that the work done will conform to the standard methods as recommended by the American Society for Testing Materials, the Portland Cement Association and the American Chemical Society. In fact, in installing new equipment, special attention was paid to procure only such apparatus as has been approved by standardization committees of various technical societies and organizations.

The first floor above the ground floor is devoted to the routine work relating to chemical control and operation, and contains one large main room, a balance room, locker room, office and a store room, together with a toilet room and shower bath. The furniture of the main room comprises two large steel and "Alberene stone" chemical tables, each large enough to accommodate four persons. Each table has a large sink and is equipped with gas and electrical attachments. There is also a large combustion table supplied with air, gas and electricity. The air is supplied by a motor-driven Crowell rotary air pump for pressure or vacuum. The air system is equipped with a reservoir which provides a steady and uniform supply.

The furnishings also include two titrating tables of special design for volumetric work. The water still table is also of special design. The hoods, of which there are two,



One of the balance rooms, showing the balance table specially designed to minimize external oscillation and vibration of the delicate balances resting on it



One of the two hoods, each of which is equipped with electric hot plate and furnace, compressed air and gas. The air compressor (right) and electric water still (left) are shown

one of them being on the second floor, are constructed of "Alberene" stone and enameled steel supports. The draft is produced by two motor-driven fans which exhaust in the air above the roof. The efficiency of these hoods may be judged by the fact that the smoke of a cigar several feet away from the hood is drawn into the hood and disappears behind the asbestos baffle board, which is part of the hood's construction. The hoods are 10 ft. in length and 3 ft. deep and are equipped with gas, electricity and air.

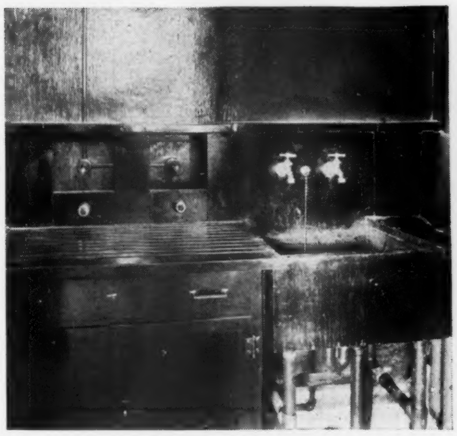
For drying and conditioning samples, a Freas electric oven with constant temperature regulator is used and is a part of the standard equipment.

For the work which the chemical and testing department is called upon to do, precision and accuracy in weighing small samples, residues and precipitates are paramount. For such purposes, two Henry Troenmer No. 10 and one Christian Becker analytical balances are used, together with the necessary scales and balances for special and general purposes. The balance tables of which there are three are of special design. Each table, weighing between 200 and 300 lb., consists of heavy enameled steel supports with an "Alberene stone" top, in which is embedded a heavy felt pad, all of which is surmounted by a 1-in. plate glass top, thus insuring cleanliness, stolidity and a minimum of vibration and oscillation.

The second floor plan is somewhat similar to the first, with the addition of a photographic dark room furnished with steel cabinets, stone table tops, shelves and sinks. This floor is devoted to special work pertaining to production and service. While the standard equipment is much the same as that on the first floor, it also contains apparatus for special work.

Even the roof, aside from serving its first and real purpose, is so constructed and designed that it has additional and special uses.

The construction of the roof consists of reinforced cinder concrete fill, covered with 3/16-in. Vendor roofing slate and laid in



A corner in the photographic dark room

Vendor plastic compound over waterproofing membrane. The roof is surrounded by a substantial concrete coping. It may be seen that this construction affords unsurpassed facilities for observing the action of weather and atmospheric conditions on cement, concrete and structural material test pieces made up for observation.

The Nazareth Cement Co. proposes to adopt and apply to greater extent than ever before a policy of service to the cement trade.

The Burrell Engineering and Construction Co., Chicago, were contracting engineers and builders of the laboratory.

British Standards for Blast Furnace Portland Cement

THE BRITISH ENGINEERING STANDARDS ASSOCIATION has now published a new issue of the British Standard Specification for portland blast furnace cement (No. 146—1926), which was first issued in 1923.

The modifications follow precisely the same lines as those introduced into the current issue of the British Standard Specification for portland cement issued in 1925 (report No. 12), the following being the principal alterations embodied in the 1926 edition of report No. 146:

(2) Provision has been made for testing in hot countries at temperatures up to 95 deg. F. In climates where the temperature runs above 95 deg. or below 58 deg., special arrangements have to be made between the vendor and the purchaser unless the ranges given in the specification can be artificially produced.

(3) The cement is now required to be more finely ground, the permissible residue on a 180-mesh sieve being 10% instead of 14%. Tolerances are laid down for the number and size of wires and size of openings in sieves both for cement and for sand. The minimum size of the sieving area is now specified to be 50 sq. in. and the minimum depth of the sieves to be 2¾ in.

(4) The maximum figure for the hydraulic modulus of the portland cement clinker has been raised to 2·90 and the maximum limit for magnesia is now 4%.

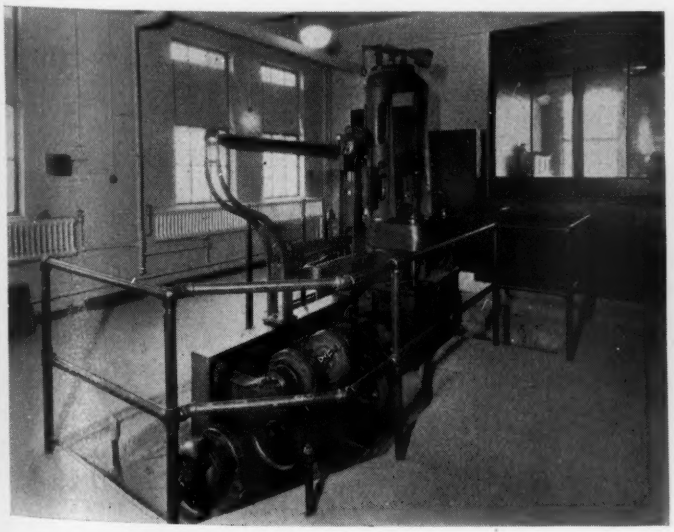
(5) The minimum tensile breaking strength of neat cement after seven days has been increased to 600 lb. per sq. in. and that of cement and sand after seven days to 325 lb. per sq. in. The 28-day test on neat cement has been eliminated.

(6) The amount of water for gaging cement and sand briquettes is now to be ascertained by means of a formula based upon the amount needed to produce the plastic mixture required in the tensile test for neat cement.

(7) The standard Leighton Buzzard sand is required to be of the white variety, and its loss of weight on extraction with hot hydrochloric acid is not to exceed 0.25%.

(8) The initial setting time of normal setting cement is to be not less than 30 min., and the initial setting time of quick-setting cement not less than 5 min.

Copies of this publication (No. 146—1926) can be obtained from the B. E. S. A. Publications Department, 28 Victoria street, London, S. W., price 1s. 2d. post free.—*The Quarry & Surveyors' & Contractors' Journal.*



Ground floor, showing the 200,000-lb. testing machine

Office of chief chemist in the new laboratory

Proportioning Raw Cement Materials

Calculations More in Keeping With Present Day Trend of Cement Requirements

By G. R. Brobst

IN view of a number of criticisms on the various methods of proportioning raw materials in cement manufacture which appeared at different times, and some admitted errors in the calculation by the writer in a previous article, it was deemed of possible worth to present a calculation more in keeping with the present day trend of cement requirements. Errors may still exist in these calculations and open criticisms will beyond a doubt lead to a better understanding of the process. The raw materials usually consisting of limestone and clay, shale, cement, rock or furnace slag, the calculations are:

Limestone		Shale	
SiO_2	2.00	SiO_2	58.00
Al_2O_3	.50	Al_2O_3	22.00
Fe_2O_3	.50	Fe_2O_3	4.00
CaO	53.00	CaO	1.00
MgO	1.00	MgO	1.00
Loss	43.00	Loss	14.00
	100.00		100.00

It has been the practice to use coal of about 10% ash and it is on this account that Eckel's formula usually applies for making raw mixture calculations. Practice, however, has changed and it is found necessary to make a good calculation to take into consideration fuel with an ash content of from 8% to 16%. The formula evolved by the Bureau of Standards applies to clinker only and is no more applicable to making raw mixture calculations than Eckel's formula was or is now. It appears that the making of raw mixture calculations depends upon individual desires and the nature of the material used.

If we have materials as above given we may use the following formula:

$$\frac{3\times\%SiO_2+\%R_2O_3}{\%CaO+1.4\%MgO}=1$$

In many of the plants now built with waste heat arrangement all the ash goes into the material during calcining and if we have fuel of 12% ash the relative quantity of necessary limestone will be greater than when a fuel of 8% ash is used or when gas or oil are used which have no ash at all.

Limestone

$SiO_2 = 2.00\times3.0 = 6.00$
$R_2O_3 = 1.00\times1.0 = 1.00$

Acid limestone=7.00
$CaO = 53.00\times1 = 53.00$
$MgO = 1.00\times1.4 = 1.40$

Base limestone=54.40
Available limestone=47.40

Shale

$SiO_2 = 58.00\times3.0 = 174.00$
$R_2O_3 = 26.00\times1.0 = 26.00$

Acid shale=200.00
$CaO = 1.0\times1 = 1.00$
$MgO = 1.0\times1.4 = 1.40$

Base limestone= 2.40
Available shale=197.60

$$\frac{197.60}{47.40}=4.17$$ parts limestone necessary to one part of shale, ash being 12%.

It is possible to increase or diminish the SiO_2 ratio in the formula 2% for each per cent of ash above or below 12%. For the raw materials in the table using gas or oil for calcining, the formula should be:

$$\frac{2.76\times\%SiO_2+\%R_2O_3}{\%CaO+1.4\%MgO}=1$$

When coal containing 12% ash is used the calculation is as follows:

	Limestone	Shale	Per cent
SiO_2	$= 2.00\times4.17$	$+58.00\div5.17$	$=12.80$
Al_2O_3	$= .50\times4.17$	$+22.00\div5.17$	$= 4.65$
Fe_2O_3	$= .50\times4.17$	$+ 4.00\div5.17$	$= 1.17$
CaO	$=53.00\times4.17$	$+ 1.00\div5.17$	$=42.96$
MgO	$= 1.00\times4.17$	$+ 1.00\div5.17$	$= 1.00$
Loss	$=43.00\times4.17$	$+14.00\div5.17$	$=37.40$
Total—			100.00—.02

As the ignition loss is 37.40 the clinker total is 62.6 to which must be added 3% for ash when 100 lb. of coal are required to calcine one barrel of clinker, thus making the clinker total 65.6. Coal ash analyzing as follows:

$SiO_2 = 45.00\%\times.03 = 1.35\%$
$Al_2O_3 = 35.00\%\times.03 = 1.05\%$
$Fe_2O_3 = 18.00\%\times.03 = .54\%$
$CaO = 1.00\%\times.03 = .03\%$
$MgO = 1.00\%\times.03 = .03\%$

Total =100.00 =3.00%

The clinker analyzes as follows:

	%	%	
SiO_2	$=12.80+1.35\div65.6\times100=$		21.58
Al_2O_3	$= 4.65+1.05\div65.6\times100=$		8.69
Fe_2O_3	$= 1.17+ .54\div65.6\times100=$		2.61
CaO	$=42.96+ .03\div65.6\times100=$		65.53
MgO	$= 1.00+ .03\div65.6\times100=$		1.57
Total—			100.00—.02

We may now tally results as follows:

Formula (Bureau of Standards)

$$\frac{2.3\%\ SiO_2+1.7\%\ Al_2O_3+\%\ Fe_2O_3}{\%\ CaO+1.4\%\ MgO}=1$$

$SiO_2 = 21.58\times2.3 = 49.63$
$Al_2O_3 = 8.69\times1.7 = 14.77$
$Fe_2O_3 = 2.61\times1.0 = 2.61$

Total— 67.01
$CaO = 65.53\times1.0 = 65.53$
$MgO = 1.57\times1.4 = 2.20$

Total 67.73
Difference of .72

About 4% gypsum is added to the clinker to control the setting properties as well as to increase its plastic properties.

Gypsum analyzing as follows:

$SiO_2 = 7.48\%\times.04 = .30\%$
$Al_2O_3 = .40\%\times.04 = .02\%$
$Fe_2O_3 = 1.48\%\times.04 = .06\%$
$CaO = 29.41\%\times.04 = 1.18\%$
$MgO = .50\%\times.04 = .02\%$
$SO_3 = 40.18\%\times.04 = 1.61\%$
$H_2O = 20.55\%\times.04 = .81\%$

Total =100.00 =4.00%

The cement will then analyze as follows:

$SiO_2 = 21.58+ .30\div1.04 = 21.03$
$Al_2O_3 = 8.69+ .02\div1.04 = 8.37$
$Fe_2O_3 = 2.61+ .06\div1.04 = 2.56$
$CaO = 65.52+1.17\div1.04 = 64.14$
$MgO = 1.57+ .02\div1.04 = 1.52$
$SO_3 = .00+1.61\div1.04 = 1.54$
$H_2O = .00+ .81\div1.04 = .78$

Total— 100.00—.08

Determination of barrels of cement in a given quantity of slurry.

Cylindrical tank diameter=20 ft.
Wt. of a bbl. of raw material (dry) 626.5 lb.
One cu. d. m.=.035314 cu. ft.
One kg.=2.206 lb.

Vol. of slurry in tank (1 in. in depth)

$$\frac{3.1416\times10^2}{12}=26.18\text{ cu. ft.}$$

$$\frac{\text{Vol. of slurry}}{.035314\text{ cu. ft.}}=741.34\text{ cu. d. m., or liters}$$

$$\frac{\text{Wt. in lb. dry raw material}}{\text{Wt. kg. in lb.}}=\frac{626.5}{2.206}=284\text{ kg.}$$

The weight of a liter of slurry may be determined by weighing 200 c.c. of slurry.

344g (wt. of 200 c.c. of slurry)—110g (H_2O)=234g×5=1.17 kg.

The specific gravity of the slurry may be determined incidental to the moisture determination as follows:

$$\frac{344\text{g (wt. of 200 c.c. slurry)}-110\text{g }H_2O}{200\text{ c.c. of slurry}-110\text{g in c.c.}}=2.6$$

or the sp. gr. of dry material in the slurry.

We may now determine the number of barrels of cement in the slurry by two methods, by specific gravity:

200 c.c. of slurry—110g in c.c.= 90 c.c. of dry material

$$\frac{90\text{ c.c.}\times2.6\text{ (sp. gr.)}\times741.34\times5}{284}=2.25\text{ bbl. per inch}$$

or by weight:

$$\frac{1.170\text{ kg.}\times741.34\text{ liters of slurry}}{284\text{ kg.}}=2.25\text{ bbl. per inch.}$$

The above slurry calculations are made on a basis of 32% moisture. The moisture may be, however, as high as 36% depending upon the nature of the material and the care exercised in the process.

Management—the Chief Essential in the Quarrying Industry*

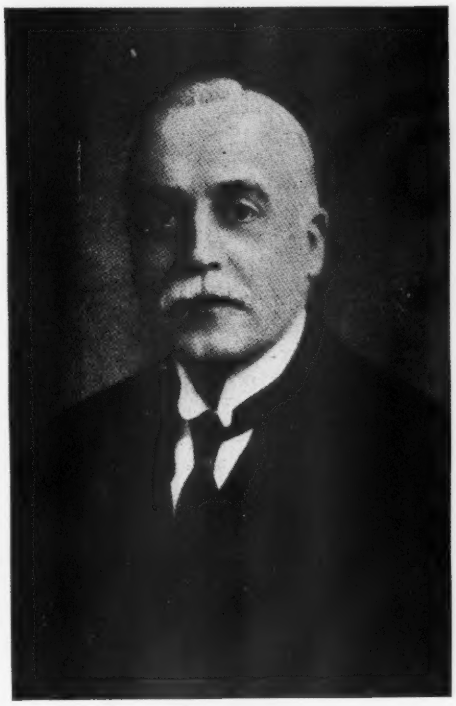
An Analysis of Management That Can Be Read with Profit by Any Executive and by Prospective Executives

By A. B. Searle

IN considering what subject I could select which would be of equal interest to all branches of the quarrying industries of the British Isles, I rapidly realized that to be of the greatest value to all members of the Institution it must not deal with any particular class of stone, or with any particular machinery or process, nor even with some single aspect, such as transport, distribution, advertising or other form of selling. It must be a subject of fundamental interest and not technical, geological, or even, in the more general sense, scientific. It must not deal with uses, nor even with that great subject of roads, because some materials which are quarried are of so highly specialized a nature. No, it must relate to men, because we are human, and it must concern itself with some aspect of that greatest of subjects—the human element in industry. These and other considerations led me to the conclusion that I could serve you most usefully at the present moment if I drew your attention to some modern ideas concerning management, because most of you are managers or potential managers, and this subject has, therefore, a direct personal interest to you all as well as to the Institution to which you belong.

I am the more willing to ask you to consider this subject at the present time, not merely because it is one to which I have for many years devoted a large amount of thought and of which I have a peculiar and special knowledge, but because so much has been written and spoken about capital and labor, and yet these represent only two parts of the great subject of industry; the third part, without which the capitalist cannot use his capital nor the workman his labor—the link in the chain without which no business or industry can thrive, is *management.* One of the chief reasons why the Whitley Councils have failed in many industries is that they made no provision for that numerically small, yet vitally important, section of the community which is charged with the duty of management; they provided for representatives of capital to sit on one side of a table, and for the worker's representatives on the other, but by omitting to include those who represent the management, little or no good came from many of these council meetings. The same thing applies in all the great industries; is not the most obvious thing about the coal question the fact that we read much about the owners and more about the miners; but of those whose work it is to manage the mines, using the efforts of the workers to produce the incomes for both owners and miners, on which the whole success or failure of the industry depends, we hear nothing?

*Reprinted in full from the Quarry Managers Journal (England).



A. B. Searle

A. B. SEARLE, the author of the above paper, for which he was awarded the Maybury gold medal and fellowship of the Institution of Quarry Managers is a well-known consultant in the English quarrying and allied industries. Among other distinctions, Mr. Searle has been president of the National Association of Industrial Chemists, a vice-president of the Institution of Consulting Technologists; he is a fellow of the Institute of Arbitrators, and of many learned and scientific societies and in addition is the author of many well-known works on the rock products industries.

Management, then, in the fullest meaning of the term, is one of the four chief essentials in the quarrying industry; the others are capital, labor and markets. Each of these are so closely related that all are essential to any business, but as time will not permit of discussing all of them, let us concentrate on the one to which least attention is generally paid by those who talk or write most about either quarrying or any other industry.

In the first place, a man may be called a manager, and yet he may be unable or unwilling to "manage." He may answer letters; he may sell stone or lime, or whatever is produced by his firm; he may engage some men and dismiss others; he may buy all the firm requires in the way of fuel, tools, machinery, stores, and so on; in short, he may do all that his employers expect of him, and yet he may fail as a manager, simply because he does not really know how to manage.

When labor was abundant and cheap, when each workman took a real pride in his work and freely gave more service than corresponded to his wage, and when incompletely developed facilities for transport restricted competition, the mistakes due to incompetent management were far less serious than now. They could usually be counter-balanced by production on a larger scale just as overhead costs were reduced by the same method.

This condition of affairs has completely changed in our own generation. The cost of labor has increased so enormously that the whole outlook of many businesses has changed, and with this have come increasing demands for a different mode of conducting such businesses.

Casual Management

What is conveniently termed as "casual management" is that practiced by what are known as "experienced business men" who depend largely on personality and shrewdness for their success. Some of these men have analytic and synthetic minds, and reach correct conclusions unconsciously; they are the few outstanding successes. Others depend on meeting problems as they arise and settling them as best they can, but without

any systematic application of knowledge. If they are lucky and the majority of their decisions are correct, they prosper; otherwise they join "the 90% of men who enter business and fail."

One of the ear-marks of the firm under casual managment is that everyone employed by it is supposed to know all about his job, so no one dare admit ignorance. The result is an amount of camouflage which may eventually wreck the business; production costs and figures for output are inaccurately recorded, overhead expenses are erroneously distributed, and goods or materials are sold below cost, while it is expected that a profit will be made. More often than not a firm under casual management is badly equipped, over-manned and under-supervised.

Casual management is based on guesswork and "experience." Under it all the weaknesses of human nature are rife, business becomes a gamble, often with the dice loaded against the shareholders. No wonder that under such a system there have, in the past, been mental breakdowns as well as many business failures in the quarrying industry—many of them simply because men have tried to know everything and do everything personally in a large business by the same methods as they used in a small one. These failures simply prove that this is now-a-days impossible, and that the management of business today must be on a different line: the continued prosperity of the business must be less at the mercy of some superman who has been able, after a fashion, by sheer ability to assimilate sufficient of the basic facts of the business to keep it going satisfactorily.

Successful Business

Successful businesses may be divided into three groups:

(1) Those based on a monopoly; i. e., they have some material, process or invention which no one else can sell or use—at any rate within a competitive area.

(2) Those based on a strategic position, e. g., specially favorably placed for their particular business.

(3) Those founded on service, like a hotel or a departmental store, under highly competitive conditions.

Quarrying belongs to some extent to all three kinds, for (*a*) it is monopolistic in the sense that suitable stone is limited to certain localities; (*b*) the position of a quarry often determines its success or failure and (*c*) the conditions in some localities are often highly competitive.

Effective management is least needed in a monopolistic quarry, but it becomes increasingly necessary as greater transport facilities enable quarries in other districts to compete. In the strategic type of business, the management must be much more alert and effective and the administrative function of management which is responsible for securing the facts and interpreting them so as to create the most profit-making policy is of great importance. In a highly competitive business the maximum efficiency in management is a vtial necessity if the business is to succeed.

The best type of management is that based upon facts, with an administrative policy determined by statistics and a budget, with all the employees kept in action by fair treatment, by accurately placed responsibility and by reward in proportion to accomplishment. This is the type of control which is being increasingly employed in all our leading industries, and those quarries which are using it are those which are obviously the most successful. When the administrative control of a quarrying business is properly organized, the man or men responsible for shaping its policy can assimilate at a glance the facts which would take weeks or months to ascertain under the older system. There is no need to carry a huge mass of information in one's mind nor to worry lest something has been overlooked, as the slightest departure from normality is immediately noticed, investigated, and can usually be corrected before much harm is done. Moreover, decisions are much more likely to be sound than those made hurriedly by an overworked manager or chairman.

What then are the essential functions of management, without which no business can, for long, succeed, but which, applied to a small and badly handicapped business, may make it into a large and highly successful undertaking?

The duties of management are partly administrative (i. e., concerned with the policy of the business), and partly executive (i. e., concerned with the movements of the plant, machinery and people employed by the firm in order to carry out successfully the policy of the firm).

In other words they are (i) to set the men to profitable work, to keep them working, and to pay them such wages as will result in a profit to the firm; (ii) to see that all machines and other appliances are maintained in good condition, that they are repaired when necessary and replaced when such replacement is beneficial; (iii) to provide such reserves as may be required to purchase new plant when needed; (iv) to see that the machinery is kept fully at work; (v) to see that sufficient orders are secured for all the products of the firm; (vi) to exercise such supervision as will result in production at the lowest possible cost; (vii) to settle disputes between the firm and others, and, in brief, to control the business to the fullest possible extent and to develop it to the utmost of which it is capable.

Administrative and Executive Ability

Of these various functions, undoubtedly the most important—though all are indispensable—is the power to plan and to carry such planning to completion; it is, in other words, organizing power and executive ability—the power to see visions and to act upon them; the ability to turn dreams into deeds. Without this inborn power, no man can be a successful manager; many have it in a latent form, existent but unused, like an acorn on a shelf—"The promise of that which might be great" lying imprisoned in the "shell" that now exists!

At one time it was thought that executive ability, or, in more homely phrase, the power of "getting things done," developed unaided and that it could neither be bought nor taught. Even today this is partially true, but that wonderful scientific study of the human mind, which has made such remarkable advances in recent years, has now shown that the latent power of management exists in almost every one, though to a very large extent, it lies dormant because few quarry managers know of any formal method of developing it and there are no "schools" where it is taught. So while out of every hundred quarrymen there are at least 90 who, if taken young enough, would make good managers or under-managers, only two or three ever attain such a position, and of these not more than one in three becomes more than what one may truthfully call — without any disrespect to the others—a first-class manager. The others *manage* to some extent, but their abilities still remain more latent than active. It has long been my hope that some day we may have attached to this institution a School of Quarry Management, where young men of ability may learn how to develop their facilities and either in this country or abroad to show, as our forefathers have done, that we British have a genius for management which is not equaled by any other race in the world.

Personal Influence

Closely allied to executive ability and the power to see or plan ahead is another faculty which is quite as essential—the power to cause others to act upon our plans, to do what we require. This I term "personal influence," because, in these days, some of the phrases formerly employed would be misunderstood. In most of the older managers this ability is exerted in an unconscious manner, but there is entering into the world of commerce and industry a number of young men with a definite knowledge of psychology who are applying scientific theories to the way in which they handle men, and they are meeting with an astonishing amount of success. This is only another instance of the way in which it is now possible to learn how to do things which, a few years ago, were thought to be quite unteachable, and it also shows how much greater is the scope for many a man than most of us realize. Quite a lot of nonsense has been talked and written about applied psychology, but this subject has at least shown that it is worth attention, even in an industry which, like quarrying, seems so remote from it. After all, because mind is far greater than matter, an ideal manager ought to know at least sufficient of the rudiments of how one mind acts on others to be able to miss no advantage which such a

knowledge will give him in dealing with the men under him. As "labor problems" increase, and the older methods of management become less potent, managers will find it increasingly necessary to increase their powers by a greater knowledge of how mind acts on mind.

In short, every quarry manager must be a practical phychologist, even if he does not know it. The men under him may work with hammer and chisel, with engines, cranes and other appliances, but the tools with which the manager works are *men*, and he must know how to use them to the best advantage. He must know how to inspire each of the men under him to do their best. He praises one and blames another; he does the same thing in his business as a first-class teacher in his class, applying just the treatment to each individual which his expert knowledge and experience of human nature has taught him is necessary in order to inspire each to do his best.

The development of personal influence, like that of other inborn gifts, lies at present with each individual—but the younger generation is learning far more about it than most of us older ones realize, and what we have had to gain by the slow and painful method of experience they are learning far more rapidly, and certainly in quite different ways.

Technical Knowledge

Will you think me altogether too old-fashioned if I enter a plea that a technical knowledge of quarrying is an essential to the successful management of quarries? I am fully aware that there have been several striking instances of remarkable managers who have had little or no knowledge of the technique of the industry in which they made their name. A single swallow does not make a summer, and the fact that here and there men have left other industries and succeeded beyond all expectation in the management of quarries is not sufficient reason for supposing that they would not have done far better had their technical knowledge been greater. As for men of lesser genius, surely we shall all agree that, for them, some technical knowledge—even if it is not very great—is really an essential to successful management.

It would only weary you if I went into details of other qualities essential for successful management. Important as they are, they are well known and appreciated and so need not even be listed. We can spend our time better in considering some of the ways in which a successful manager uses his abilities, so that, perchance, from such a consideration, some half-successful manager may become wholly successful, or some ambitious youth may the more easily reach the goal of his ambition.

Improvement in Production

One of the results of a very extensive investigation on which I have recently been engaged has been to show that we appear to be nearing the end of great improvements in machinery, and though far too many quarries do not use machinery and modern methods to the extent to which they should do, the best-designed quarries in this country have little or nothing to learn from even the most advanced concerns in other lands. It is now possible to obtain reliable machines and other appliances for doing almost everything that can be done mechanically in a quarry. The best explosives available are almost all that can be desired. Steam navvies made in this country are far more efficient and far more durable than any in general use abroad. Cranes and other lifting tackle can do all that is required of them; simple means for loading and emptying wagons are in existence; transport problems in and about the quarries are not seriously concerned with the appliances used, but with other matters, and crushers, screens and kilns have reached a state of development which is, on the whole, very satisfactory. So that, while great improvement can and will be effected in some of the *parts* of machines—more durable jaws in crushers is only one instance out of many which might be mentioned—it is true to say that, on the whole, there is available all and more than all the machinery and appliances we need for the maximum development of the quarrying industry in any part of the world, and that in this respect we are approaching the end of the great epoch in which production has been increased enormously by the use of mechanical appliances and by the application of the great sciences of chemistry and physics to industry. At the same time, we are at the commencement of a new epoch in which men will no longer be content to be treated as many have been in the past, but will demand increasing comforts and facilities, shorter hours and less physical strain, the development and exercise of brain rather than brawn. Such demands can only be met in one way—by the far greater use of mechanical appliances, which, in order to be profitable must work on a much greater scale than is or has been necessary. Overhead expenses must be reduced, the cost of selling (per ton) must be reduced, and the amount of sales must be enormously increased either by finding new uses for the products or by so reducing the selling prices that fresh customers can be secured on a large scale.

A New Era Dawning

If I am correct in this, it surely follows that the demands on the management both as regards production and sales, will be far greater in the future than in the past, and for a very simple reason: so long as we work under conditions where we can take on more men when trade is brisk and dismiss them when trade is slack, many errors in management, much lack of foresight and the absence of sufficient selling ability can be covered up in a number of ways. Directly a large quantity of machinery is introduced these sins of omission and commission are rapidly realized, for a machine cannot be "sacked" for a few months and "taken" on again when required. Its purchase involves the management in a responsibility for finding it work during the whole of its useful life. Nay, more, a machine can work far longer than a man, and consequently if it is to be used to the fullest advantage, it should work almost continuously, stopping only for such brief periods as are necessary for inspection, oiling or repairs. It is useless to argue that there is not enough work to keep a machine going continuously, for, unless I am mistaken, the day is not far distant when competition will be so keen that one of the first methods to meet it will be to work many existing machines continuously instead of only 48 or 50 hours a week. The manager who can keep his plant working 140 hours a week will be able to reduce his overhead expenses so seriously as to prove a most serious competitor to others who work only during daylight.

When the greater part of the work is done by direct human labor, and little or no machinery is used, the capital required is comparatively small. If it is sufficient to pay the wages, salaries, rent, rates and taxes for three months, it will usually be ample, and many firms have succeeded with far less than this. Directly much machinery is introduced, however, an entirely different state of affairs is brought about for the machinery has to be bought outright and, in most cases, it will not repay the capital expended on it in less than 10 to 15 years. This enormous increase in the amount of capital required has had a very serious effect on the manner in which modern businesses are managed, for in many cases the owner can no longer provide all the capital needed from his personal resources, but is compelled to associate with a number of other people—often with neither knowledge of nor real interest in the business and quite unable to exercise the functions of capable management—the difficulties of such management being greatly increased by the new conditions brought about by the introduction of machinery to do the work of men.

One Man Only Must Actually Manage

As successful management must inevitably center in one man in each firm—for a board of directors or a committee can no more fulfill all the duties of a manager than it can drive a railway train—modern conditions are imposing increasingly severe strains on the managers who must, in many cases, not only do their legitimate work, but, in addition, must *manage* the directors! Hence the ever-increasing demands for men of outstanding ability not only in one but in several subjects, to undertake the management of these rapidly growing concerns. Attempts at organizing department managers, deputy-managers, and so on, are all good in their way, but they do not really lessen the strain on the management as a whole, rather do they increase it and call for additional abilities on the part of the manager-in-chief,

whatever may be his actual title or position.

No longer is quarrying a pleasant hobby for a land-owner aided by a good foreman or a livelihood for a man of small means who knows intimately all he employs; it has become a big business, and must be managed like all other big businesses, by men of special training and ability. As competition increases, the demand for still further machinery will also increase and, apart from a limited number of places where the conditions are quite exceptional, the small quarries which depend almost wholly on hand labor will be "squeezed out of existence." Indeed, this process is already at work to a far greater extent than is commonly realized. A solution to this problem will not be found in politics; neither free trade nor any form of protection, nor acts for the safeguarding of industries will help it; it can only be solved by a greater employment of the powers of management applied on a far larger scale, with a far greater courage and with a much wider outlook than is at present common in quarrying. A few progressive firms have already taken some steps in the right direction, but this is no time for halting; the industry must march forward as a whole or it will suffer lamentably from the greater enterprise of people who are able to deliver foreign material in this country at attractive prices.

Market Research

A second important feature of the new era which is dawning—or rather which has already dawned—is the necessity for much greater skill, knowledge and energy on the part of the management than now exists in many works, in order that the present and potential markets may be developed to the fullest extent. It is still the custom to suppose that the market for the stone from any quarry is limited to the orders which can be obtained by the experienced and hard-working travelers and agents employed by the firm. This is a fatal error which strikes at the very root of successful management. In the most progressive of other industries it has long been recognized that while travelers secure *orders*, the majority of them can only get new business as a result of extensive *preparation* by the management. The existence of sales managers, the remarkable results that accrue from well-planned advertising campaigns, and the many other ways in which interest is developed among non-buyers of any particular article, all prove that, today, the traveler only forms a relatively small part of the selling organization, and that the greater part of it must necessarily be the direct concern of the management.

In this connection, one of the most striking features of the new era of business generally, and this will apply equally in the near future to the more progressive quarries, is the interest being taken in "Market Research," i. e., in a careful and detailed study of the product in all its possible forms, including all by-products, combined with an equally detailed, painstaking and ingenious investigation of all the purposes for which it can possibly be used, and all persons or firms to whom it can be sold. Like many other big advances in business, this idea of market research is essentially a British idea; it has been used in a few industries in this country for many years with marked success, but like many other good things, it went over to America where its possibilities were at once realized, and where it has been developed with the most astonishing results, only to be acclaimed in this country as another American invention!

Market research is, possibly, a new term, but the idea it embodies is as old and as sensible as many British concerns. It means neither more nor less than a careful investigation by a really competent person—not necessarily the manager or indeed any person on the board or staff of a quarrying concern—of all the possibilities which exist for selling the material, either in the ordinary forms in which it is now produced or in such other forms as may make it particularly suitable for an entirely different market.

Let me take only one part of the quarrying industry as one instance of what may be done as the result of such an investigation. It was found on inquiry that railway rates for lime and for stone crushed to various sizes could be obtained which would enable these materials to be sent to five very large markets at distances from the quarry which were so great that no one had had the temerity to attempt to enter four out of these five markets so far as this particular stone was concerned. It was also found that other markets nearer at hand could be developed to a far greater extent than had been done in the past if only various small difficulties respecting deliveries could be overcome. The investigation also revealed the fact that what had always been regarded as the most profitable part of the business was actually run at a loss, and that what was considered to be a *side show* was really keeping the business on its feet at the time the investigation was being made. Not only so, but the accumulations of material which had been tipped for any length of time up to fifty years ago were found to be capable, after a comparatively inexpensive treatment, and the purchase of plant which the quarry owners were not aware was in existence, of being sold at an exceptionally profitable rate in almost every part of the country; the very *defects* of the material from the quarry owners' point of view being the most attractive *selling point* when put before prospective buyers in a proper manner. Finally, the conversion of the small lime (which had previously been sold to farmers at about one-third of its actual cost of production) into a material which realized something like 8% more profit than lump lime, brought a further notable sum into the owner's bank account, and is likely to continue to do so for some years to come.

It may be argued that there is nothing new in this, and yet the fact that these particular quarries had been carried on for so long in a half-successful manner shows that the possibilities were overlooked until someone with greater powers of management was able to apply his ability to see the various matters in correct perspective, and then to make his dream come true.

Vision Needed

It has well been said that "the impossible is only that which lies just beyong the limit of what we understand," and those of us who in various ways have been able to accomplish what our friends and others have declared to be "impossible" know only too well how thin is the veil which prevents many from seeing the vision which would lead to their success. Often it is not so much a question of genius as of ingenuity; frequently it is far less a matter of deep knowledge than of clear perception. Most of us suffer from a peculiar form of blindness; through long habitude we fail to see defects in our business which are only too obvious to an outsider, and for that reason someone freshly entering the business may, by his greater power to see things as they really are, be able to make improvements which were never even dreamed of by those previously in charge. Herein lies the value of retaining a consultant advisor.

Many instances might be quoted, but one small one must suffice. A quarry owner some time ago took a friend for a stroll; they walked through part of the quarry on their way back and alongside the railway line had to step on to a heap of material in order to get out of the way of the locomotive. The friend noticed that the heap was composed of a fine white powder overgrown with rank vegetation. Shortly after, in searching for a fine powder for a purpose of his own, he remembered the heap near the quarry, tested it, treated it in various ways, and today that heap exists no longer. That material, and many more tons of similar material, form the basis of one of the best known toothpowders. In this instance, the quarry owner merely disposed of his *refuse;* the *big profit* went to the man who saw how to convert it into something for which there is an enormous sale regardless of the price or value of the raw materials employed.

That branch of management which concerns itself with market research does not consist solely in finding the extent of existing markets for the material produced at present; it takes into consideration other markets which would be opened if the material were rendered suitable; it does not accept opinions; it proves whether statements are facts and whether they represent the whole or only a partial truth.

Particular as Well as General Data

Market research applied to a particular quarry involves not only a survey of possible customers for what is now produced—it includes an investigation of the defects of

the material with respect to certain uses and of how these defects can be overcome. It involves an investigation into the whole technique and procedure of production, the ascertainment of relative costs, profits and losses of each stage between the purchase or rental of the stone to the receipt of the check in payment of materials sold. In most cases should be prepared and a sales program it also involves considerations of the capital invested in the business in relation to that which ought to be invested; sometimes it may lead to the withdrawal of large sums and on other occasions it may show the absolute necessity of an increase of capital. Until the initial data are obtained for any particular business, it is impossible to say what conclusions will be reached or what results will be obtained.

One mistake which must be avoided at all costs is to consider that conclusions from a partial investigation are reliable. Many failures have been due to this cause, and one of the surest steps towards bankrupty consists in drawing conclusions which are erroneous because of an insufficiency of facts. Such an error is most likely to be made by a manager who is sadly overworked because either he or those over him have failed to plan effectively in the past. For this reason some of the largest industrial firms place market research in the hands of someone outside their own staff, and thereby gain all the advantages without serious risk.

Standards of Performance

Under modern conditions, all except the smallest quarries must be managed in such a way as to include standards of performance as well as recording actual results; a financial forecast and a budget are essential.

The actual procedure is as follows:

1. A budget or financial forecast is prepared which should include the economic reasons for the existence of the business, its objects, the amount of business to be secured and the costs of securing such business and executing the orders.
2. The part which each employee should play in securing profits should be determined.
3. Responsibility is distributed as widely as possible, and yet one man should have the duty of final decisions and seeing that everyone acts up to his own responsibilities.
4. Sales quotas for different districts should be prepared and a sales program drawn up.
5. All expenses should be anticipated, grouped according to their nature or departments, and compared with the budget, which should be similarly arranged.
6. The actual results obtained should be compared week by week with the budget, and the standards set. Any discrepancies should be examined minutely, and steps taken to correct them.
7. Future standards should be modified according to experience.

The result where such a system of management exists should be:

1. Organized foresight replaces decisions based on guesswork.
2. A team-play for a fixed objective is developed, so that there is a great effort to secure results.
3. Responsibility is rightly distributed, yet *divided responsibility* in the ordinary sense of the phrase is avoided.
4. A greater knowledge of the facts of the business is available.
5. The expenses are reduced and the reasons for each are known.
6. The earnings approach the maximum possible under existing conditions.
7. There is greater satisfaction on the part of all concerned because there is greater understanding and more active co-operation between all the parties.

To secure the best results the work of investigation should begin with a careful analysis of the whole business, beginning with the balance sheet and the profit and loss account and extending through every detail of the business, so that the precise profit or loss on every order and on every piece of material sold can be accurately known. Once this analysis is completed, the lines along which economies or greater profits can be secured can usually be visualized. Plans can then be made to rectify errors, to liquidate overcapitalized sections, or to supply other lines with more capital; unprofitable items can be dealt with and either abandoned or made profitable.

Once simple and accurate records have been introduced, facts come to the management in a forcible form, progress can be accurately measured and losses reduced or avoided.

As an instance of what may be effected by a careful survey followed by equally careful planning I may mention one firm in the quarrying industry in which the following benefits were realized:

Breakdowns and stoppages were reduced by	75%
Railway demurrage was reduced by	47%
Output was increased by	16%
Excess of men employed reduced by	28%
Productivity per workman increased by	17%
Fuel saved	23%
Bad debts reduced by	8%
Profits increased by	97%

The regular and systematic examination of all the basic facts upon which the success of a quarrying business depends, forces the management to probe into all kinds of things whose importance would never be realized if it were not for such a method of control as that described.

It might be thought that with so much statistical and investigational work a quarry manager would lose his driving power, but this is not the case. The man at the head of a modern, effectively managed quarry has just as much personality and force as his predecessors, but he possesses more real character. He has learned to delegate authority and to free himself from work which can be done better and more cheaply by others. Those under him know that they will be judged honestly and fairly by results and not by opinions or appearances, so that the tendency to suppress facts is reduced to a minimum. Such a man learns the truth and is able to act accordingly. He is respected, even though he may not be popular. His criticism is constructive, and he is not afraid to praise as well as to blame. He is unhurried and courteous. He has time for constructive thought and to give useful help where needed. He does not hesitate to call in expert advice. He asks rather than orders. Needless to say, all under him are loyal; they stay with the firm, and the losses, inevitable when experienced men leave and new ones are engaged, are very low. Under such management the whole organization operates like a first-class machine — quietly, rapidly and effectively.

Limited Management

In these days of limited companies, a large number of directors have only meager qualifications for management; many of them indeed being mainly interested in securing immediate dividends without due regard to the future of the business. They are not to be blamed; it is their misfortune that they lack the necessary knowledge to develop their business to its fullest extent. If such a board of directors is blest with a really good manager—one who is worthy of the name and not merely a foreman or a nominee—it will do well to use his ability to the utmost, supplementing it with such outside advice and assistance as they can obtain. No man knows all there is to know about quarry management, so that such assistance is usually necessary from time to time, and a wise board will see that it is obtained. Many boards of directors make the mistake of thinking that they constitute the management, whereas in actual fact they do nothing of the kind. Consequently, they unduly limit such powers of management as may be available, either among themselves as individuals or among those they employ. This is a fatal error, and one which is extremely difficult to eradicate because of the many interests involved. Yet is must be avoided if true success is to be reached.

The ideal board of directors does not attempt *management* in the technical sense of the term. Its chief function is with finance, which is a very different matter and calls for quite different qualifications. Such a board will employ people gifted with the power of management; it will engage, from time to time, those who can supply the necessary data and ideas; it will aid the management with finance, as far as it is possible to do so, and it will rigidly limit itself to reaching sound and right conclusions on facts put before it by competent persons in whom it has confidence, leaving these decisions to be carried out by the management in as far-sighted and able a manner as possible. It will regard the management as its ablest instrument and, so far as the business is concerned, as its best friend. Happy is the able manager who works for such a board!

Woe to him whose hands are tied, whose powers are restricted, and whose best efforts are thwarted by the well-meaning inefficient directors who labor under the delusion that they *manage* the business!

Management: An Art and Science

Hitherto, management has been an *art*—"a way of doing things" acquired by practice and by intuition rather than by knowledge; the result of experience associated with an inborn power. Through ignorance it has only too often proved a harsh way, but gradually, through the ages, "persuasion takes the place of fear." We must always admire the manner in which the quarrying industry has been "made by men who knew their duty, and had the courage to do it, and who, if ever they failed in what they undertook, freely gave their lives as the fairest offering . . . . their glory lives . . . may it be proclaimed forever, on every fitting occasion, both in words and deeds."* Yet so great and so swift have been the changes in every direction during the last 20 years, experience is no longer the best teacher, and instead of an art, management must now be based on science, i. e., on the systematic accumulation of knowledge summarized in a convenient form. No longer can a man afford to spend the best part of his life in gaining an experience which will fit him for management; he must make the fullest use of the experience of others in many branches of industry and knowledge; he must study and observe and travel in order that he may know and perceive and develop to the uttermost the powers of his personality which will make him a qualified specialist in his work.

There is one danger in this new attitude which must be avoided—the danger which comes whenever science is combined with art, the risk that knowledge shall be mistaken for action and that the soul which gives to art its beauty shall be crushed in the mechanism of what is mistakenly regarded as a scientific outlook. Such a danger always shows lack of imagination; it is an infallible mark of mediocrity, and it must be avoided whatever may betide. Instead of less imagination, we need more. Rules and formulas are only steps by which we may climb the more rapidly towards our goal; they must be our tools and not our masters, and on no account must we allow our soul to be lost by the materialization of our art—the art of management by which we live.

Members of the Institution of Quarry Managers, the whole industry depends on your being in fact, as well as in words, the real managers of the concerns in which you are engaged! If you restrict your mental energies and become merely foremen or the victims of a routine out of which you do not escape, you are missing some of your greatest chances of life. Good management by men of wide vision, deep knowledge, unprejudiced outlook, and sound judgment is needed more than ever in these difficult days. It is as you enlarge your understanding of all that true management involves, as you appreciate increasingly that it means far more than you thought, even a week ago, as you resolve to realize in yourselves the highest ideals of the noble work in which you are engaged, to which you devote so much enthusiasm and energy, and on which you pour so unstintingly those exceptional powers of personality you possess, you will show to men in similar positions in other countries that genius for sound management which is so characteristically British, and of which we are so justly proud, and you will provide a standard of attainment and an example to men in other industries which, in comparison to your own most ancient and honorable one, are but as the dew which fell in the grass yester-eve compared with the hills around!

Some of you are proud of the hardness of the rocks you quarry; some of you rejoice in the toughness of the stone in connection with which you spend your lives; do not, I beg of you, make the mistake of thinking that *management* consists merely in the use of force, of harsh words and cruel acts. The day of the "task-master" has passed long since, and today men must be ruled in other ways.

Hardness in management has its place on rare occasions, but on most days you would do well to remember that most men are neither granite nor whinstone nor limestone, rather do they resemble that other rock, equally a part of the great quarrying industry in which you are interested—a rock whose value lies in its yielding rather than in its resistance; a rock which has made poets in all ages marvel at the skill with which men have *managed* so soft and pliable a material, and while, like Follet, you realize that "the basis of successful management is understanding," may you, along with your forcefulness, your incisiveness and your quickness of decision, retain that essential humility and a true sense of the rights of those under you for:

"Though some must follow and some
command,
Yet all are made of *clay*."

*Thucydides.

Appendix

In order to indicate the kind of statistical information on which effective quarry management can best be based, the following figures should be collected over a number of years and continued in the future. Some of these may, with advantage, be made into graphs or charts which show *at a glance* the more important changes which take place. The ratios vary so much with different branches of the quarrying industry that definite figures have purposely been omitted.

I. FINANCIAL.

(A) A financial forecast or budget contrasting probable receipts and expenses based on the anticipated production and sales for a year hence. Allowance should be made in case sales increase above the estimate.

(B) Balance sheets ratios should be extracted for the past ten years or more to show:

(*a*) Ratio of current assets to liabilities.
(*b*) Ratio of assets receivable to total assets, indicating nature and cause.
(*c*) Ratio of accounts payable to total assets.
(*d*) Ratio of reserves to total assets.
(*e*) Ratio of bank balance to liabilities.
(*f*) Ratio of fixed assets to market value.
(*g*) Ratio of assets receivable to sales.
(*h*) Ratio of stock in hand to sales.
(*i*) Ratio of stock in hand to total assets.
(*j*) Ratio of sales to total assets.
(*k*) Ratio of gross profit to total assets.
(*l*) Ratio of dividend (or net profit) to total assets.
(*m*) Ratio of each source of capital to total assets.

(C) The following figures should be set out on charts for each year:

(*a*) Net working capital (assets less liabilities).
(*b*) Percentage of earnings left in business.
(*c*) Capital turnover (net sales divided by capital).
(*d*) Stock turnover (net sales divided by stock).
(*e*) Gross earnings and costs in each separate department.
(*f*) Cost of borrowed money.
(*g*) Analysis of stock in hand.
(*h*) Analysis of buildings, plant and machinery, showing separately those not in use.
(*i*) Average prices (price index).
(*j*) Analysis of cost and expenses per £100 of sales subdivided into:
 (1) Net sales.
 (2) Manufacturing costs of
  (*a*) Stone.
  (*b*) Labor.
  (*c*) Fuel.
  (*d*) Supplies.
  (*e*) Other expenses.
  (*f*) Total.
 (3) Gross profit.
 (4) Interest on loans and capital.
 (5) Depreciation.
 (6) Repairs and renewals.
 (7) Bad debts.
 (8) Surplus profits.
(*k*) Range in prices of goods or materials sold.

II. PRODUCTION. (In quantities not financial terms.)

(A) Total output of sales.

(B) Output and sales of each department separately.

(C) Unabsorbed burden (difference between output and sales)—total and by departments.

(D) Stock record.

(E) Losses (by departments):
 (*a*) Spoiled products (including stone tipped to waste) in value and weight.
 (*b*) Idle time (in hours and value).
 (*c*) Repairs.

(F) Efficiency-ratio of actual output of each machine or man to what each is capable of doing under normal conditions. Reasons, if low.

(G) Labor control.

(*a*) Number of men engaged and left.

(*b*) Wages in district for each class of labor.

(*c*) Available labor not at work.

(*d*) Number of men in each department (1) actually at work; (2) needed for full output.

III. SALES.

(A) Total sales value.

(B) Total quantity of sales, also itemized by products or departments.

(C) Seasonal sales in value and quantity month by month.

(D) Sales, orders, despatches, daily and monthly.

(E) General sales expenses (analyzed).

(F) Sales arranged in districts.

(G) District information:

(*a*) Names of districts.

(*b*) Nature and size of possible and actual sales in each district.

(*c*) Quota per district.

(*d*) Ratio of actual sales to quota, by districts.

(*e*) Quantity required by each customer, arranged in districts.

(H) Information to meet competition.

(*a*) Principal competitors and information thereon.

(*b*) Prices and costs as far as ascertainable.

(*c*) Selling methods.

(*d*) Quality.

(*e*) Other information.

In this section it is well to include *detailed* comparison of own firm *versus* competitors.

The foregoing is by no means an exhaustive list, but additional items, when required, can be added. For instance, the financial budget will need quotas for output and sales. The latter will need travelers' reports as to prospective business. The estimate of the market requirements in (III H) (*b*) requires a detailed investigation on market analysis and possibly calls for tests. The last section, dealing with competitors, needs the most skilful investigation in order to ascertain (*a*) which product is best; (*b*) why or in what way; (*c*) how this affects the sales; and (*d*) what can be done to meet it. Such an investigation may show that it is foolish to compete, and that the wise course is to sell the business or shut down. The information on losses should act as a frequently renewed warning. Individual efficiency (II, F) implies careful planning, detailed instructions of the men with respect to their work and the careful oversight based on acceptable standards of output. The section on labor control (II, G) involves the investigation of wages paid in other industries, such as collieries, which may draw men away from the quarry, also as to what wages or mode of payment will attract superior men who (in spite of higher wages) are usually more profitable. The item "Number of men engaged and left" may mean that men are being drawn away deliberately and this will have to be faced.

The above-mentioned information must, of course, be modified as each individual quarry requires, but when so modified it will be found to give the basis of a control and power of management far greater than is generally attained in most quarries at the present time. Yet the fact that the duty of the management is to deal with men must not be overlooked, and no system of statistics must be used in a soulless and wholly mechanical manner, or it will result in the failure which it well deserves.

Demonstrating Quarry Practice to School Children

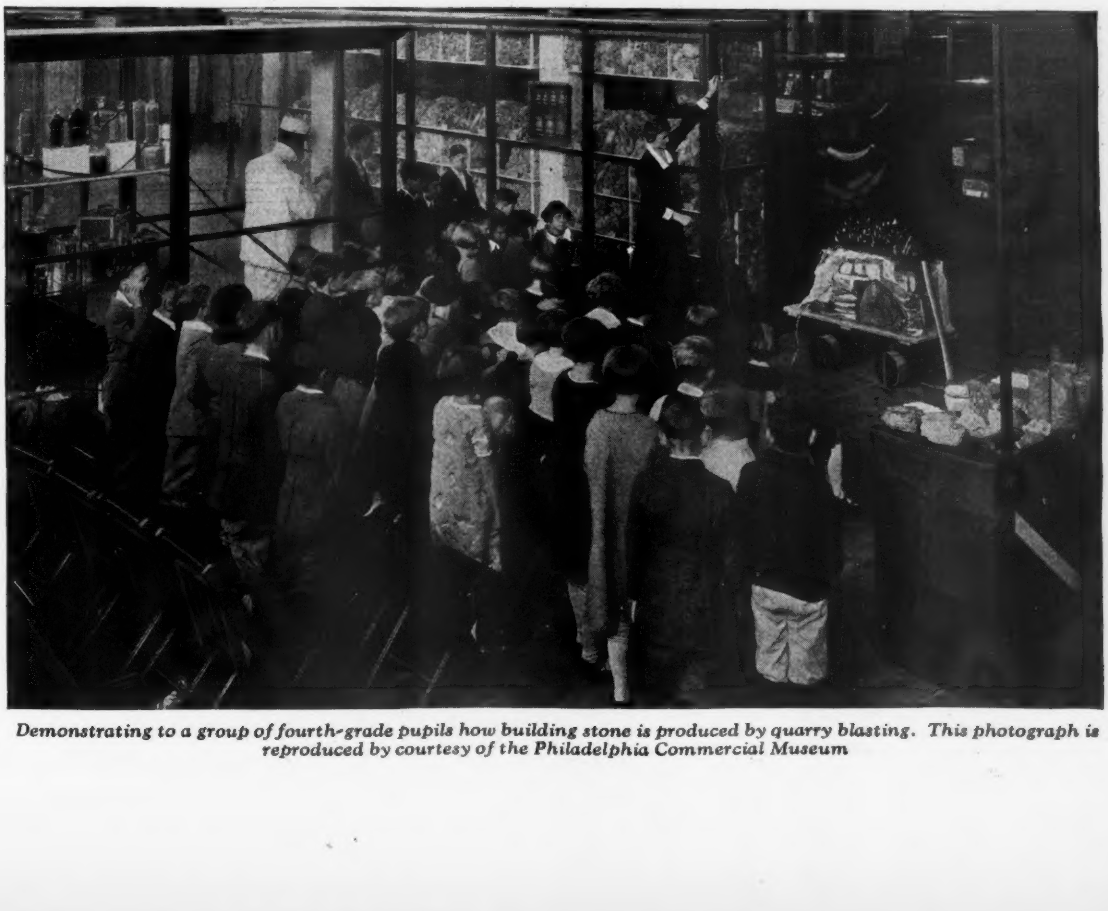
IN Philadelphia, some remarkable changes have been made in teaching methods at the public schools. In that city, the Commercial Museum, maintained primarily in the interests of commerce and industry, functions as an auxiliary of education system. For example, a geography class has been studying mineral resources. After preliminary instruction in the classroom, the class goes to the museum and is shown moving pictures on mining, quarrying, etc., and listen to lectures on the subject along with an inspection of exhibits, of models, etc.

The accompanying photo shows such a class of fourth grade pupils who want to know how stone is produced from a quarry. They have listened to the lecture; they have witnessed on the screen a big quarry shot, and now teacher is going to show them how quarrymen shoot rock from the cliff-side. A little stone quarry, probably the world's smallest and about 3½ ft. long, 2 ft. wide and 3 ft. high, is brought out on the floor. It is mounted on a truck, this miniature quarry, and it is realistic even to the trees that appear to be growing in the overburden of soil at the top. The children crowd around it, inspecting its every detail.

The actual operations in quarry practice in preparing a blast are followed. A 1-in. hole is put down and extended, the small powder charge placed, primed and tamped. While proceeding, the teacher explains the functions of the various equipment and material. A wire shield is fitted over the quarry as a guard against flying fragments, the electrical connections made and the charge set off.

Further, to impress safety measures, and while the operations are going on, the teacher talks to the class on explosives and points out what precautions for safety should be taken in handling them.

After the blast, the children are allowed to examine the product made and encouraged to compare different rocks by weight, hardness and other characteristics. This modern method of teaching children has made the children in Philadelphia actually like to go to school and established for that city an enviable reputation.—Abstracted from the *du Pont Magazine*.



Demonstrating to a group of fourth-grade pupils how building stone is produced by quarry blasting. This photograph is reproduced by courtesy of the Philadelphia Commercial Museum

Lime Burning With Producer Gas*

Part II.—Details of Kiln Operation and Notes on Construction

By Gustav Streck

THE method and time intervals of drawing the burned lime vary greatly in different plants. These factors are of greater importance for uniform operation of the kiln than generally supposed. In this connection I have made a series of experiments drawing at short intervals and in small quantities; at long intervals and in large quantities; tapping alternately on opposite sides of the kiln, drawing two diagonally opposite doors, etc., and I have found that it is essential that the kiln remain undisturbed a certain length of time between the successive drawings; consequently, that the time intervals should not be too short.

I let drawing occur at an average interval of four hours, depending upon the condition of the kiln, drawing all four doors in the following succession: 1, 3, 2, 4, i. e., alternating the diagonally opposite doors. The limestone column breaks as a rule at the level of the ports and falls suddenly during drawing at the last door, upon receiving a few powerful strokes of a long bar. If the mass comes down too soon, it is generally an indication that the temperature had not yet reached a sufficiently high level.

Efficient Kiln Drawing

If one would make sure that no underburned lime is removed, the lime should be burned at such temperatures that upon drawing it remains loosely hanging in the kiln. It naturally happens that the lime column does not descend uniformly, coming down stronger on one side than on the other. The sections where it comes down more rapidly should then be burned with a light flame, as described in a previous article, to balance the kiln. If, after drawing, one looks through the peepholes on the inside of the kiln, a bright flame should show between the lumps of rock. If dark spaces are noted, drawing has been carried too far or the preheating effect has been lost. If the kiln has a non-uniform appearance before drawing, it can be brought into balance by drawing the weaker parts last and only in small quantities.

All voids, forming in the burning zone after drawing, should be eliminated by poking the mass with long bars, as otherwise unburned limestone will result due to absence of necessary contact. This occurs when too large lumps of rock are burned in the kiln, which also results in too large void spaces. A comparison of these conditions with a loosely filled smoking pipe, made in *Tonindustrie-Zeitung* a few years ago, is very much to the point. No amount of drawing will make the tobacco burn.

Holes for poking the lime should be provided liberally and, above all, at the proper location. It is important to be able to poke the mass toward the walls of the kiln in the burning zone immediately above the gas ports, as the mass of decomposing limestone tends to become clogged there. It is also of advantage to provide single openings in the upper part of the burning zone and in the cooler for, when a wide range in size of limestone is used, the descending mass tends to cling to this part of the kiln.

UNDER the title, "Gas Fired Lime Kilns," an article which treated in a general way gas-fired kilns and the operation of gas producers was published in the issue of March 6, 1926. The present article is concerned with the operation of the kiln itself. Some of the fundamentals of kiln design are considered along with the dimensions and proportions that have been found to work well in practice.—The Editors.

Good Lime Made Only by Rigid Control

From the above it will be concluded that a gas fired shaft kiln requires viligant and conscientious operation. It is up to the director of the plant to have trained, efficient operators and to exercise rigid control. In hiring the men, less attention should be paid to intelligence than to sobriety and conscientiousness; it is recommended to employ middle-aged in preference to young men for this work. It is also important not only to arouse their interest in the work, but to keep them interested. This is accomplished by conveying to them a certain apparent responsibility to promote their zeal and by rewarding increased efficiency by an adequate bonus system.

I have introduced here a bonus system which has thus far worked very satisfactorily. A normal weekly (7-day) output was established by dividing the total weekly wages by the part of the wages per 100 kg. burned lime for normal capacity, and the latter sum was offered as bonus for every additional output of 100 kg. If the bonus per 100 kg. is designated as x and an increased output of 5000 kg. is obtained, the total bonus will be $50x$, which is to be divided by the workmen among themselves. It is not recommended to base a bonus system on daily output as variations may take place in the latter, all of which are eliminated in the weekly figures which give average values.

Kiln Construction Adapted to Types of Stone Used

I will now discuss some problems concerning details of kiln construction and will make a comparison of the gas-fired kiln with the recently introduced shaft kiln with mixed firing and automatic operation.

In fixing the total height of the gas kiln up to the charge opening and, particularly, the height of the different zones (preheating, burning and cooling zones) the properties of the rock used and economic considerations should be the determining factors. There are lime rocks which, when suddenly and rapidly heated in the preheating zone, will either immediately upon charging or at a later time, explode with a loud noise and fall to pieces. To prevent this, such materials require a very long preheating zone which, on one hand, reduces to the minimum allowable the temperature of the waste gases (for natural or artificial draft) and on the other hand, provides sufficient time for gradual preheating of the rock. It may be that sudden eruptions will occur even with most careful handling. The gas-fired kiln is not recommended for such kind of rock, as the crumbled, compactly settled mass either obstructs the course of the flame and of the draft or makes it altogether impossible. It is possible that in such cases the vertical kiln with mixed firing may be used, but it is probable that only the rotary kiln will solve all practical and economical difficulties with rock of this kind.

On the other hand, I have encountered a variety of limestone which required short cooling, as it otherwise crumbled in the kiln. This is a "Gutensteiner" limestone of the early triassic period. The limestone has a black color and has white veins of feldspar. Its analysis shows about 6% alumina. Down to the level below the burning zone it resists the strong pressure and friction to which it is subjected in the kiln. However, if it is to remain in large lumps, it should be cooled rapidly and drawn while still hot, which is possible only with a very short cooling zone. This peculiar phenomenon is

*Translated from Tonindustrie-Zeitung, by Margaret Arronet Corbin.

probably due to the very low mechanical strength of the lime.

Proper Kiln Dimensions

What dimensions should be given to a kiln providing the rock used does not require special handling in any zone? The answer is that the dimensions of the different zones should be proportioned in such a manner that, aside from the heat stored in the burned lime being utilized for preheating the air, the heat of the exhaust gases should be utilized to the maximum extent to furnish sufficient chimney draft for preheating the rock. In doing this, it is necessary to determine approximately the amount of heat to be recovered from the burned lime and the exhaust gases. Assuming a specific heat of burned lime (CaO) between 0 deg. C. and 1000 deg. C. of 0.25, 1000 kg. burned lime will yield about 250,000 W. E. (W. E. is the German thermal unit equal to 3.968 B.t.u.) With this amount of heat it is possible to raise the temperature of 1200 cu. meters of air to about 800 deg. C. (this is the quantity of air required by 1200 cu. m. of gas used up in burning 1000 kg. lime), assuming that firing proceeds without excess air, which is quite possible in a gas-fired kiln and is one of the conditions of successful operation. It may be noted in passing, that these conditions are less favorable in a kiln with mixed firing, as this requires considerably greater volumes of air for combustion, consequently lower temperatures result.

The quantity of heat obtainable from the waste gases is about three times that recovered from the burned lime, about 750,000 W. E. According to Fischer's Handbook for Heat Power Engineers, p. 288, the specific heat of limestone at 100 deg. C. is 0.166, at 1000 deg. C. 0.67. However, on p. 14 of the same edition we find the specific heat of limestone between 0 deg. C. and 100 deg. C. given as 0.21. As 1000 kg. lime requires 2000 kg. limestone, one could prove analytically that the heat obtainable from the waste gases could be completely used in preheating the limestone, which, however, is encountered in practice only in very few instances.

From the above it is apparent that the gas kiln disposes of no surplus heat, and that, consequently, heat should not be wasted either in the burned lime or in the exhaust gases. On the basis of personal experiments I have established the economical height of kiln at 18 meters (59 ft.). The height of the different zones is as follows:

Cooler	5.50 meters (18 ft.)
Burning zone	1.50 meters (5 ft.)
Preheating zone	11.00 meters (36 ft.)

The height of the preheating zone has no effect on the output of the kiln or on the quality of the burned lime. Due to shortage of material I was at one time obliged to work with a very small preheating zone, and observed no reduction of output or quality although a greater fuel consumption was produced.

Kiln Output Dependent on Effective Shaft Area

The output of a gas kiln is in the first place contingent upon the effective shaft area in the burning zone. In general 2.5 to 3.5 metric tons burned lime are figured per 24 hr. per square meter of shaft area. As the area over which the flame is effective is small, as explained previously the clear diameter of the shaft area and the spacing of the gas ports are sharply limited, and even more so as the limestone increases in purity. Judging from my personal experience the clear diameter of a gas-fired shaft kiln should not, as a rule, exceed 140 cm. (55 in.) if it is desired to obtain uniformly burned lime, without underburned or overburned material. If this dimension is exceeded, a uniform product is no longer obtainable as either a certain percentage of underburned lime is produced or longer firing is required to completely calcine the limestone at the center. The efficiency of the kiln is thus lowered, the fuel consumption is raised and overburned lime forms in the vicinity of the gas ports.

Due to limited clear diameter, circular kilns cannot be built to exceed a certain limiting capacity. If greater output is desired, the kiln is designed with elliptical or, better yet, with rectangular cross section with rounded corners, the minor axis naturally limited to 140 cm. (55 in.), while any desired dimension may be given to the major axis. For the sake of completeness, let me add that for greater capacity interior colums are sometimes built in circular kilns with or without additional gas injection at the columns. The kiln is thus heated from the inside as well as from the outside. It may be emphasized here that this type of construction requires frequent repairs to columns and gas entrances, which, unless located properly, become clogged with adhering fused lime. The latter applies to gas ports at the circumference of the kiln as well, unless they are arranged so that during the descent of the lime column in drawing, the rock immediately above and below the ports is certain to slip.

Large Circular Shaft Diameter Impractical

Thus the kiln with built-in columns does not present an ideal solution of the problem of obtaining kilns of greater capacity. In addition to this, its cost of installation is considerably higher than that of a kiln with elliptical or rectangular cross section. It is my opinion that the plain shaft kiln should remain without columns, and that a method be sought to increase the clear diameter of the shaft area and, consequently, the output of the kiln, at the same time producing uniformly burned lime over the entire shaft area.

Various methods have been tried to produce thorough burning in kilns with large shaft diameter; however, no unquestionably good results have been obtained. Starting out with the shaft kiln with grate firing where the finished voluminous flame enters the burning zone at a certain pressure, and for this reason is effective over a large area, one has tried to mix air and gas immediately before entering the kiln and to direct the flame thus produced into the kiln. A secondary air supply was used for this purpose. The air required for combustion was admitted at the bottom of the shaft, was driven upwards in currents along the inside walls of the kilns, becoming heated to a certain degree, and finally reached the gas supply. Special care was taken that no oxidizing flame was produced, as this creates very high temperatures at the walls of the kiln and penetrates even to a shorter distance towards the center, becoming deflected towards the regions of highest temperatures. The greatest disadvantage of a shaft kiln with secondary air supply is that the air for combustion is preheated very little; most of the heat stored up in the burned lime becomes lost and, consequently, the fuel consumption is raised.

Improving Pre-heating Conditions

Other experiments were directed towards improving preheating conditions, i.e., it was sought to keep the waste gases away from the circumference of the shaft and to force them towards the center. This was an excellent idea because stronger preheating at the center, if successful, eliminates all difficulties of uneven burning at the center of the burning zone. To accomplish this purpose, the shaft cross section was increased in the preheating zone and was reduced about 3 meters (10 ft.) above the gas ports, where no danger remains of clinging masses of lime. This method of construction, no doubt, has certain advantages: it creates a large preheating space, permits a reduction in kiln height and thus diminishes the pressure on the burned lime in the preheating zone. It also improves preheating conditions at the center, though not to the desired extent. Very little or no success was encountered in experiments consisting in introducing fresh air in the preheating zone in order to artificially cool the outside of the mass and thus to direct the heat towards the center; this was due to the fact that admission of fresh air reduces the draft in the burning zone and thus lowers the efficiency.

As stated above, no completely satisfactory results were reached in these various experiments. It is my opinion that economically operated gas kilns of large capacity will be introduced only with the use of pressure gas. Gas delivered under pressure, i.e., the flame produced by it at the entrance to the kiln is effective over a considerably larger area and permits considerable increase of the clear diameter of the shaft and thus of the shaft area and of the kiln output. Further, firing should take place entirely within the kiln as this is the only way to achieve a complete and economical utilization of the heat of the fuel. The gas should be forced to the ports at uniform pressure and should

here combine with the air, which in rising should be directly preheated by the burned lime and the volume should be capable of regulation. All shaft kilns which mix the flame before it enters the kiln, i.e., inject an already burning flame into the kiln have to face the heat losses which mean increased fuel consumption.

In comparing a gas fired shaft kiln with an automatic kiln with mixed firing as to economy and suitability, one should consider the cost of installation, output, fuel consumption, labor and the quality, uses and sales value of the lime.

The introduction of automatic operation in shaft lime kilns is a novel feature; therefore, almost as little information is available in literature on this subject as on shaft kilns with pressure gas. The conclusions drawn here may, therefore, appear to lack details of one or the other type of kiln.

Cost Comparison of Automatic and Gas-Fired Kilns

The cost of installation of the two kilns, assuming equal output, should show little difference after the cost of producers, blowers, etc., is balanced against that of automatic devices.

The fuel consumption is undoubtedly lower in the shaft kiln with mixed firing than in the shaft kiln with pressure gas firing, as the latter presents unavoidable producer and transmission losses. However, the shaft kiln with mixed firing does not permit a complete utilization of the fuel value, as in the upper part of the shaft heat is lost in the escaping gases which are gone so far as the process of combustion is concerned. Further it is to be considered that combustion of gaseous fuel always takes place more efficiently and under more favorable conditions than of solid fuel. Aside from this, the air supply becomes preheated to a greater extent in the gas fired kiln than in the kiln with mixed firing. It may also be stated that the kiln with mixed firing can operate economically only when coke is used, consequently its operation is limited to one type of fuel. The gas fired kiln is quite independent in this respect. It permits the use of any fuel which can be most cheaply obtained per heat unit. This is a very important consideration when the lime plant is located near coal mines or peat deposits. It would be useless to attempt to express the difference in fuel consumption in figures as the real comparable values are the thermal units used per unit weight of lime and cost of these.

The labor is practically the same for the two types of kilns, so long as charging of the producers and drawing of the lime proceeds making extensive use of automatic devices.

With reference to the quality of burned lime there is no doubt that the gas-fired kiln yields a more valuable product. In the kiln with mixed firing the fuel comes in direct contact with the limestone; the lime, therefore, contains impurities such as ash and is not suitable for chemical purposes or such other uses where absolutely pure lime is required. The gas fired shaft kiln, however, yields a chemically pure lime which is suitable for uses on construction as well as chemical purposes and, therefore, has a higher sales value. In general, it may be said that the kiln with mixed feed should be recommended wherever no value is attached to purity of the product; the gas fired kiln, however, should be used where freedom from impurities is a requisite.

In conclusion, let us summarize the above as follows:

Requirements for Economical Operation of Gas-Fired Shaft Kiln

1. A good and uniform gas supply.
2. Good kiln draft.
3. Closely watched regulation of firing conforming to the condition of the kiln; more especially, correct proportioning of gas and air volumes required for combustion.
4. Rational procedure in drawing the kiln.
5. Trained operators and constant supervision of their work.
6. Correct selection of fuel.

Fundamentals of Design of a Gas Fired Shaft Kiln

1. A good knowledge of the properties of the rock used and of its behavior in the different zones.
2. Proper selection of height of kiln and of the different zones.
3. Proper selection of clear diameter of shaft area and of the vertical spacing of the gas ports.
4. Proper shape of kiln for unobstructed downward passage of the lime.
5. Proper design of gas ports with special reference to clogging by lime, etc.
6. Provision of a sufficient number of adequate holes for cleaning purposes and purposes of observation, particularly in the burning zone.
7. Good control of gas and air supply.
8. Accessibility for cleaning purposes of channels and flues.
9. Limiting combustion to the burning zone.

For large daily capacity: construction of rectangular kilns without columns, use of pressure gas, extensive use of automatic devices for charging the producer as well as for drawing and handling the lime.

Reply to Article "Some European Types of Lime Kilns"

SIR—Reading this article in ROCK PRODUCTS, August 7, p. 56, published by H. Halbig, one should expect a dissertation on a wide scope of different kiln constructions, but not a propaganda article of a single kiln system which so far has not proved any particular success, while other types of kilns which have been brought out just recently are merely referred to with a few insignificant remarks.

The statement that "shaft kilns today make almost exclusive use of gas as fuel" goes considerably too far; in Germany today most of the shaft kilns employ the so-called mixed firing, i.e., the material to be burnt and the fuel are introduced into the kiln by hand or automatically in alternating layers. That in such mixed firing, similar to a boiler gate, the fuel cannot be heaped in layers of several foot thickness and that a correct proportion must be maintained with the air introduced is a matter of course just as much as that the ratio between air and gas in a gas-fired kiln must be accurately adjusted. It is easily possible to obtain a complete combustion with residue of ash or other impurities in using mining coke in a shaft kiln with mixed firing, without large excess of air, without carbon monoxide (CO), but with 36% of carbon dioxide (CO_2) in the waste gases. Mining coke in comparison to gas coke is produced of high quality coal with particular care as a main-product for blast furnaces and is therefore free of any impurities, while gas coke as a by-product in the production of illuminating gas still contains the less volatile constituents and a higher content of ash.

If a shaft lime kiln is operated with such mixed firing for the manufacture of hydrated lime, it is possible to use low-grade and therefore cheaper coke tailings in introducing air pressure. In this way the manufacturing costs of hydrated lime will be brought down to the lowest level. The consumption of coke in this case amounts to between 8 and 10% computed on limestone or between 17 and 18% with regard to the burnt product (about 1200 calories per kilo of burnt lime) when using high-grade limestone of 98% $CaCO_3$ content, and a coke of between 6500 to 7000 calories and not between 20 and 30% computed on limestone as with gas firing, stated in the article above referred to.

The firm Curt von Grueber Maschinenbau Aktiengesellschaft, Berlin-Teltow, is at present building automatic shaft kilns with the above favorable consumption of fuel for any required capacity and has built a most modern plant for the Bergenspektion Rudersdorf at Kalkberge near Berlin. There are other shaft kilns besides with this for mixed firing, even of older construction, with a consumption of fuel between 17 and 19%, computed on burnt lime, using fuel of equal value (6200 cal.) as referred to in the gas-fired shaft kiln.

The above mentioned fuel consumption is in fact the principal demand for any modern kiln with mixed firing, when the kiln is properly run. Such shaft lime kilns with mixed firing with a daily output of 90 tons may be also found in Westfalia, Germany, in the Rheinisch Westfalische Kalwerke Honnetal, near Minden.

Considering the less expert workmen in the lime industry, experience shows that it is easier to properly run a shaft kiln with this mixed firing than a gas-fired kiln. The main difficulty in operating such gas-fired shaft kiln is always the durability of the lining, which, owing to the high temperature at the point where the gases enter the kiln, is considerably affected, and will therefore have to be renewed within much shorter time than the lining of a shaft kiln with mixed firing. There has been done considerable experimental work by German experts regarding the durability of linings for gas-fired shaft kilns, but the writer of the above mentioned article does not refer to this point at all. That the gas-fired shaft kiln, if only proved a success and having overcome its infantile defects, will be an ideal apparatus, is a matter of course, if only for the reason that the material to be burnt and the fuel are not intermixed. So far, however, the kiln with mixed firing, which—when well constructed and well run—gives splendid results, is being justly preferred to the gas-fired shaft kiln. I may add that in Germany, even in erecting new works, the ring kiln is still being adopted, which with one fire produces 50 to 60 tons daily, and double this quantity with two fires, with a consumption of fuel, when properly run, of 1200 cal. per kilo of burnt lime, i.e., 24% of fuel having only 5000 calories.

This ring kiln has the only advantage that the limestone leaves it in the same size in which it is brought in. As long as European lime consumers lay stress on these large lumps in the burnt lime, which is solely a prejudice, the ring kiln will keep its place in spite of the great disadvantage that feeding and emptying absorbs five to six times more in wages.

GERHARD SEEGER,
of the Association of German Lime Works, Berlin W. 62. Kielganstr. 2.

August 27, 1926.

Burning Small Stone in Rotary Kilns

Most of the Core Comes from the Finest Portion Which Cannot Be Well Burned

By Victor J. Azbe
Consulting Engineer, St. Louis, Mo.

THE stone fed to rotary lime kilns should be as uniform in size as is permitted by practical considerations. If there is a lack in uniformity, and especially if very small material is present, it will be found that a large portion of the fines will not be burned.

In a case brought to the writer's attention the tailings received from the hydrator were excessive so that he decided to make a study of the problem presented. First, a sample of the coarser particles discharged from the cooler was taken and washed and the core remaining was found to be 1%. Next, a sample of the smaller particles of lime as discharged was taken and washed. In this case, the remainder (core) was 20% of the original weight. This great difference brought to light that the small stone charged to kiln either contained more impurities than, or it could not burn as well as, the coarser portion. To further study this matter, a sample of the lime and a sample of the limestone were taken for complete analysis.

The samples at the laboratory were first screened through screens having three and six meshes to the linear inch, thus giving three samples of each lime and limestone. The tabulation gives the results of analysis.

CHEMICAL ANALYSES

	No. 1	No. 2	No. 3
Insoluble	3.80%	4.63%	3.62%
Fe_2O_3 and Al_2O_3	3.45	2.45	2.80
CaO	81.15	74.89	80.97
MgO	9.69	9.50	8.24
$CaCO_3$ (core)	1.34	8.50	33.43
	99.43%	99.97%	98.80%

	No. 4	No. 5	No. 6
Insoluble	2.50%	3.38%	3.58%
Fe_2O_3 and Al_2O_3	.72	.88	.92
CaO	48.75	47.75	47.88
MgO	4.71	5.03	5.03
CO_2	43.39	42.96	43.06
	100.07%	100.00%	100.47%
$CaCO_3$	87.00	85.22	85.45
$MgCO_3$	9.85	10.52	10.52

SCREEN ANALYSES

Lime Sample

No. 1—On 3-mesh	29.2%
No. 2—Through 3-mesh and on 6-mesh	43.0
No. 3—Through 6-mesh	27.8
	100.0%

Limestone Sample

No. 4—On 3-mesh	25.3%
No. 5—Through 3-mesh and on 6-mesh	56.6
No. 6—Through 6-mesh	18.1
	100.0%

Samples called Nos. 1, 2 and 3 are lime and limestone passing through a 6-mesh screen was from slightly above to considerably below ⅛ in. in diameter. The percentage of this small material was 27.8% by weight in the lime as discharged and 18.1% in the limestone as fed, this being a considerable quantity. There was more in the lime than in the limestone because fines were created by abrasion in the kiln.

In analyzing the samples it was found that the impurities in limestone were equally distributed in the various sizes. That is, the fines portion had about as high a lime content as the coarse portion. The calcium and magnesium carbonates carried between 95.64% and 96.85%. The calcium carbonate content ranged between 85.22% and 87%, while the magnesium carbonate content ranged between 9.85% and 10.52%.

This test proved that the small grains are as good limestone as the coarse, and if they cannot be converted to lime there must be some other cause than the presence of impurities. The test on the lime itself proved that the limestone core remaining after the charge was discharged from the kiln is only 1.34% in the lime above the 3-mesh, that is coarse portion, and 8.5% in the medium size, that is the portion remaining on 6-mesh. The fines, those passing 6-mesh, had 33.43%.

If the insolubles, iron and aluminum oxides and the CO_2 in terms of calcium carbonate core are added, the total impurities in the lime passing 6-mesh are 39.65%, of which 33.43% is core. Figuring on the same basis, the lime remaining on a 3-mesh screen contains 8.59% total impurities, of which only 1.34% is unburned lime.

It will be noted that the calcium oxide content drops off very rapidly as the fineness of the lime increases. In the material around ¼-in. to ⅜-in. size, the calcium oxide is 81.15%, while in the material below 6-mesh it is only 50.97%. This makes the lime less suitable for certain purposes.

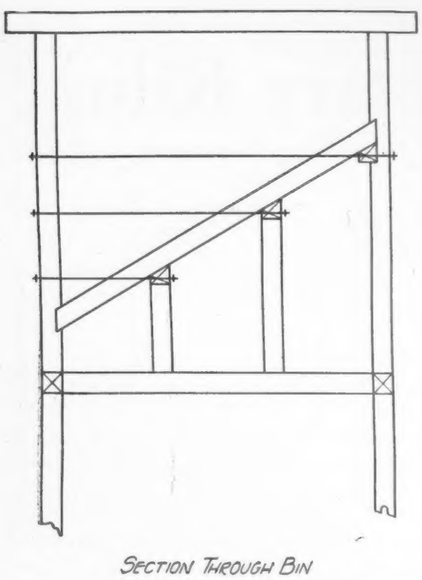
One would expect that the small pieces would burn easier than the coarse, and they do, if they become exposed to heat. In the rotary lime kiln, however, lime is burned almost entirely on the surface, while exposed to kiln hot walls and flame; only a small amount is burned in contact with the walls. The flow of the fine material is, however, such that it reaches neither the top of the charge nor the bottom.

Under these conditions the kiln would naturally be operated so there would be a minimum of core in the discharging lime. Since it is apparently impossible to completely burn the ⅛-in. and down size, it becomes apparent that any effort at reduction of core will reduce kiln capacity and so also kiln efficiency. Most of the lime is held in the kiln much longer after it is completely burned, in the effort to burn the fines which refuse to be burned. This not only decreases kiln capacity and efficiency but the life of the lime-kiln lining also. If the fines would be screened out the kiln would give more lime, better lime, and fuel consumption would be less.

Hints and Helps for Superintendents

Method of Building a Bin

THE sketch and photograph show a somewhat unusual bin. The bottom slants at 45 deg. and the timbers supporting it are considerably lighter than they would be for so long a span if it were not for the system of construction used. The sketch shows the method of construction. A timber is

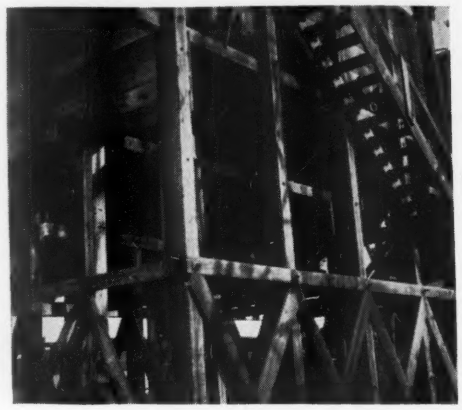


Details of bin with 45-deg. bottom

carried across under the bottom timbers and tied to the vertical timbers on the front of the bin with rods. This transfers some of the pressure on the bottom of the bin to a tension on the rods. The bottom bins have hence to support only the load on a relatively short span. Light posts are placed under the beams through which the tie rods are passed and these rest on beams placed below. These serve to give stability to the construction.

Improving the Work of a Sand Settling Tank

AT the Forestport, N. Y., plant of the Boonville Sand Co. automatic sand settling tanks are used. These are of the type that open the valve when the sand accumulates sufficiently to change the center of gravity to a point at the side of the knife edges on which the tank is hung. This causes the tank to swing away from the valve and allows the settled sand to run out. The deposit contains some fine sand, most of which is removed by the flow through the tank. But at times the fine sand formed a hard mass on one of the sides of the tank and weighted it so the tank would not swing away from the valve. Part of this fine sand is magnetite, which is a very heavy mineral



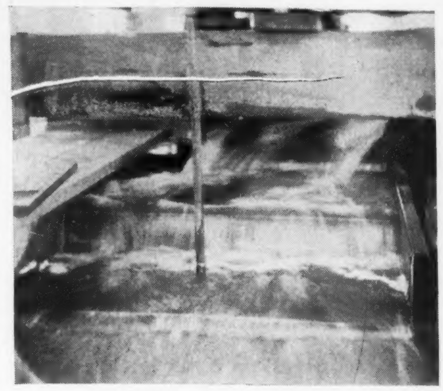
System of bin construction which allows the use of light supporting timbers

and which tends to pack on account of its magnetic qualities. To cure this packing of the sand on the side water was introduced through a horizontal pipe with ¼-in. holes. The use of water in this way not only stopped the packing of the fine sand but it had a classifying effect and threw out the fine sand in greater quantity. This improved the grading of the concrete sand.

The line drawing shows how the pipe was placed in the tank and the photo the appearance of the tank after the water was turned on. What appears to be a wave in the front of the tank is the disturbance of the flow through the tank by the water rising from the holes in the pipe. The vertical pipe shown in the picture brings in the water to the horizontal pipe below. This device is due to John Wagoner, superintendent of the Boonville company's plants which are located at both Boonville and Forestport. A description of the Forestport plant will appear later.

Emergency Repair to Gyratory Crusher

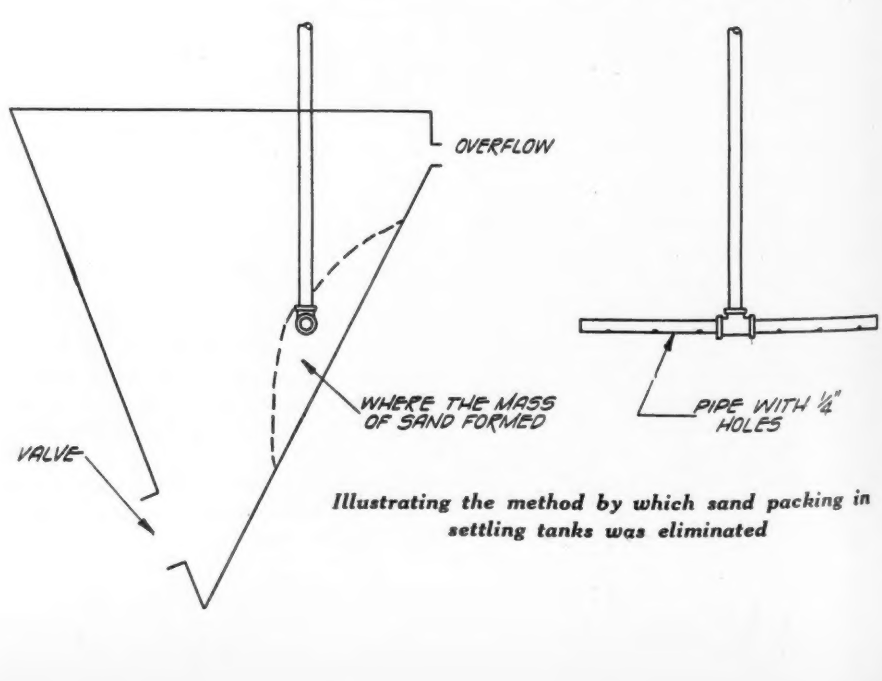
THE Buffalo Crushed Stone Co. recently met with an accident that is likely to happen at any crushing plant. This plant has a No. 12 Gates gyratory crusher, installed in 1910, which has been crushing stone without intermission, save ordinary upkeep repairs, for these 16 years. One fine summer day, when everything was going lovely and production was in full swing,



Sand settling tank after water was turned on—pipe feeds water to perforated pipe below

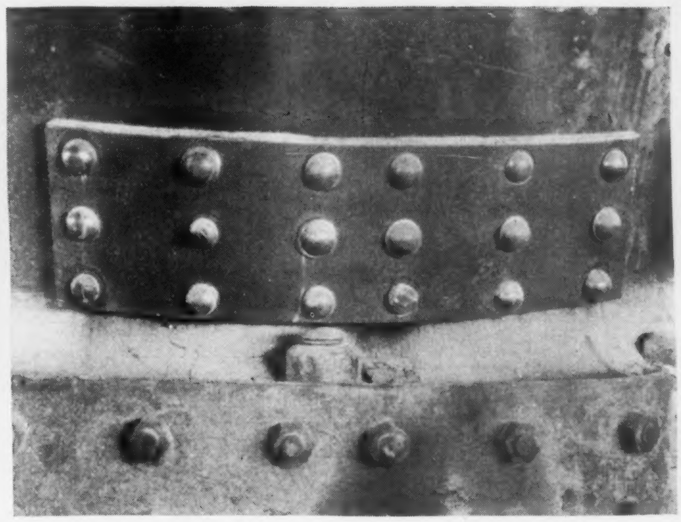
a quarry-car wheel dropped off and landed in the crusher. As luck would have it, the emergency electric switch failed to stop the crusher, as it should have done.

Gyratory crushers, or at least this particular one, are not designed to crack cast-iron car wheels, so the crusher itself cracked—both top and bottom castings, clear through the flanges where they are bolted

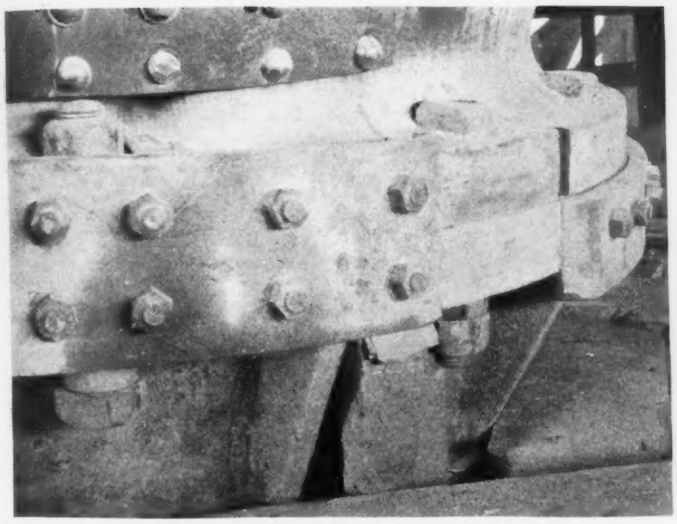


Illustrating the method by which sand packing in settling tanks was eliminated

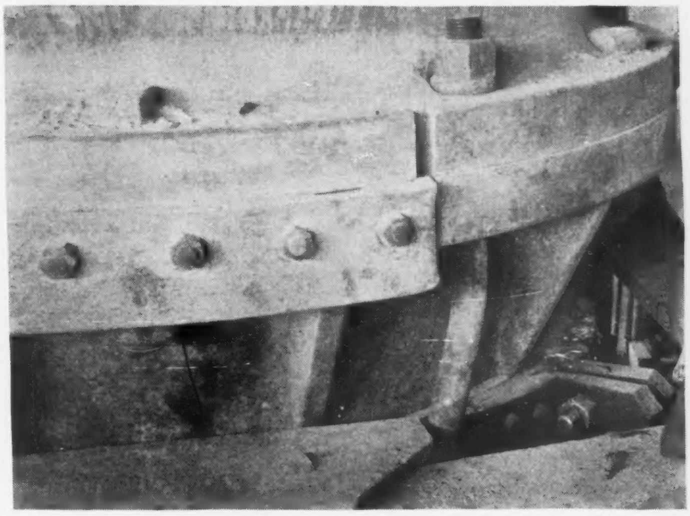
Top band bolted on melted zinc backing



Patch riveted to top shell casting



Keyed-in strap patch on top-shell flange



Keyed-in strap patch on bottom-shell flange

Rod connection ties two castings together

together. But James Savage, secretary and general manager of the Buffalo Crushed Stone Co., is an engineer and a resourceful man. In 17 working hours the crusher was in service again—and still was working fine at last reports.

The first step was to take out the bolts, which fasten the two halves (upper and lower) of the shell together. The two halves were then shifted about 25 deg., so that the cracks in the upper and lower shells, instead of being continuous, were staggered. Patches were riveted over the cracks in the body of each shell. A heavy strap or band of wrought iron or low carbon steel was bolted around under the head of the crusher. Melted zinc was poured between the band and the crusher shell before taking up on the bolts, to insure an even bearing all around. The two flanges, where the crusher shells are joined near the center of the crusher, were cut into to make slots or keyways for the turned-over ends of wrought-iron straps, which bridge over the cracks.

The first of these straps was wide enough to cover both flanges, but in placing the second one on the cracked bottom shell it was considered unnecessary to include the upper flange. These bands were placed on the crusher hot and shrunk on, practically closing the cracks. They were then fastened to the flange rings by tapped-in bolts.

To give further rigidity to the crusher the two bolts on the outside of two patches were removed and replaced with rods which extended through the lower flange and hooked through a link or yoke fastened by a pin or bolt to stiffening webs in the bottom casting. On account of the necessary bend in these rods, it was difficult to tighten them adequately by means of the nut on top. These rods have subsequently been replaced by rods with turn buckles.

All the work was done by the plant mechanics. The only outside assistance needed was in fashioning the ring band which goes around the top of the crusher.

It might be added that the car-wheel which caused all the damage, was not very seriously injured—just bent a little!

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co. (common)[2] new stock	Sept. 27	No par	37	40	1½% quar. Apr. 3
Alpha Portland Cement Co. (preferred)[2]	Sept. 27	100	115	....	1¾% quar. Mar. 1
Arundel Corporation (sand and gravel—new stock)	Sept. 27	No par	35	35	45c qu., 15c ext. July 1
Atlantic Gypsum Products Corp. (1st 6's carrying 10 sh. com.)[10]	Sept. 29	....	109	113	
Atlas Portland Cement Co. (common)[2]	Sept. 27	No par	42	44	50c quar. Sept. 1
Atlas Portland Cement Co. (preferred)	....	100	....	....	2% quar. Oct. 1
Atlas Portland Cement Co. (preferred)[2]	Sept. 27	33⅓	43	46	2% quar. July 1
Beaver Portland Cement Co. (1st Mort. 7's)[8]	July 29	100	100	100	
Bessemer Limestone and Cement Co. (common)[4]	Sept. 24	100	128	132½	1½% quar. Oct. 1
Bessemer Limestone and Cement Co. (preferred)[4]	Sept. 24	100	106½	109	1¾% quar. Oct. 1
Bessemer Limestone and Cement Co. (convertible 8% notes)[4]	Sept. 24	....	114½	120	8% annual
Boston Sand and Gravel Co. (common)[10]	Sept. 24	100	75	80	2% quar. July 1
Boston Sand and Gravel Co. (preferred)[10]	Sept. 11	....	....	75	1¾% quar. July 1
Boston Sand and Gravel Co. (1st preferred)[10]	Sept. 11	....	....	83	2% quar. July 1
Canada Cement Co., Ltd. (common)	Sept. 28	100	109	109⅛	1½% quar. Oct. 16
Canada Cement Co., Ltd. (preferred)[11]	Sept. 24	100	114	115	1¾% quar. Aug. 16
Canada Cement Co., Ltd. (1st 6's, 1929)[11]	Sept. 24	....	102	102¾	3% semi-annual A&O
Canada Crushed Stone Corp., Ltd. (6½s, 1944)[11]	Sept. 24	100	92	96	
Charles Warner Co. (lime, crushed stone, sand and gravel)	Sept. 27	No par	23	25	50c quar. July 12
Charles Warner Co. (preferred)	Sept. 27	100	101	103	1¾% quar. July 22
Charles Warner Co. (lime, crushed stone, sand and gravel) 7s, 1929[16]	Sept. 24	100	102½	104	
Cleveland Stone Co. (new stock)	Sept. 27	....	60	67	$1.50 qu. Sept. 1
Connecticut Quarries Co. (1st Mortgage 7% bonds)[17]	Sept. 24	100	104	....	
Consolidated Cement Corp. (1st Mort., 6½s, series A)[24]	Sept. 29	....	97	99	
Consolidated Cement Corp. (5 yr. 6½% gold notes)[24]	Sept. 29	100	96	100	
Consumers Rock and Gravel Co. (1st Mort. 7s)[18]	Sept. 25	100	99	101½	
Dexter Portland Cement Co. (6% serial bonds, 1935)[22]	Sept. 15	....	99	....	
Dolese and Shepard Co. (crushed stone)[7]	Sept. 28	50	89	91	$1.50 quar. Oct. 1
Egyptian Portland Cement Co. (7% pfd. with com. stock purchase warrants)[21]	Sept. 24	....	96	100	1¾% quar. July 1
Egyptian Portland Cement Co. (common)[21]	Sept. 24	....	14	18	40c quar. July 1
Egyptian Portland Cement Co. (warrants)[21]	Sept. 24	....	10	15	
Giant Portland Cement Co. (common)[2]	Sept. 27	50	58	62	
Giant Portland Cement Co. (preferred)[25]	Sept. 27	50	52	55	3½% s.-a. June 15
Ideal Cement Co. (common)	Sept. 28	No par	68	70	1¾% quar. July 1
Ideal Cement Co. (preferred)[6]	Sept. 24	100	106½	109½	$1 quar. July 1
International Cement Corporation (common)	Sept. 28	No par	50⅝	50⅝	$1 quar. Sept. 30
International Cement Corporation (preferred)[2]	Sept. 28	100	103	103	1¾% quar. Sept. 30
International Portland Cement Co., Ltd. (preferred)	Mar. 1	....	30	45	
Kelley Island Lime and Transport Co.	Sept. 27	100	130	132	$2 quar. Oct. 1
Lawrence Portland Cement Co.[2]	Sept. 13	100	100	110	2% quar.
Lehigh Portland Cement Co.[6]	Sept. 27	50	85½	88	1½% quar.
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1927 to 1931)[13]	Sept. 24	100	99	100	
Lyman Richey Sand and Gravel Co. (1st Mort. 6s, 1931 to 1935)[13]	Sept. 24	100	97	98	
Marblehead Lime Co. (1st Mort. 7's)[14]	Sept. 24	100	104	106	
Marblehead Lime Co. (5½% notes)[14]	Sept. 24	100	98	100	
Michigan Limestone and Chemical Co. (common)[6]	Sept. 27	....	26	....	
Michigan Limestone and Chemical Co. (preferred)[6]	Sept. 27	....	23½	25½	1¾% quar. July 15
Missouri Portland Cement Co.	Sept. 28	25	55	56	$1 quar. Sept. 30, 25c ex. Sept. 30
Monolith Portland Cement Co. (common)[9]	Sept. 23	....	11	11½	
Monolith Portland Cement Co. (units)[9]	Sept. 23	....	27	28	
Monolith Portland Cement Co. (preferred)[9]	Sept. 23	....	8	8¼	
Nazareth Cement Co.[20]	Sept. 27	No par	39¼	41½	75c quar. Apr. 1
Newaygo Portland Cement Co.[1]	Sept. 24	....	109	....	
New England Lime Co. (Series A, preferred)[14]	Sept. 24	100	92	96	
New England Lime Co. (Series B, preferred)[22]	Sept. 24	100	92	97	
New England Lime Co. (V.T.C.)[22]	Sept. 24	....	35	38	
New England Lime Co. (6s, 1935)[14]	Sept. 24	100	99	101	
North American Cement Corp. 6½s 1940 (with warrants)	Sept. 28	100	96¼	96⅜	
North American Cement Corp. (units of 1 sh. pfd. plus ½ sh. common)[19]	Aug. 14	....	94	99	2 mo. period at rate of 7%
North American Cement Corp. (common)[19]	Sept. 27	....	20	22	
North American Cement Corp. (preferred)	Dec. 31	....	....	....	1.75 quar. Aug. 1
North Shore Material Co. (1st Mort. 6's)[15]	Sept. 29	100	98½	100	
Pacific Portland Cement Co., Consolidated[5]	Sept. 23	100	69½	70	½% mo.
Pacific Portland Cement Co., Consolidated (secured serial gold notes)[5]	Sept. 23	100	97¾	99	3% semi-annual Oct. 15
Peerless Portland Cement Co.[1]	Sept. 24	10	6½	7¼	
Petoskey Portland Cement Co.[1]	Sept. 28	10	9	9½	1½% quar.
Pittsfield Lime and Stone Co. (2 sh. pfd. and 1 com.)[10]	Sept. 11	....	....	225	
Rockland and Rockport Lime Corp. (1st preferred)[10]	Sept. 27	100	105	105	3½% semi-annual Aug. 2
Rockland and Rockport Lime Corp. (2nd preferred)[10]	Sept. 11	100	....	....	3% semi-annual Aug. 2
Rockland and Rockport Lime Corp. (common)[10]	Sept. 27	No par	50	50	1½% quar. Nov. 2
Sandusky Cement Co. (common)[1]	Sept. 27	100	118	130	$2 quar. Apr. 1
Santa Cruz Portland Cement Co. (bonds)[5]	Sept. 23	....	105¾	106	6% annual
Santa Cruz Portland Cement Co. (common)[5]	Sept. 23	50	81	....	$1 quar. $1 ex. Dec. 24
Superior Portland Cement, Inc. (Class A)[20]	Sept. 23	....	42¼	42¾	
Superior Portland Cement, Inc. (Class B)[20]	Sept. 23	....	20	21	
United Fuel and Supply Co. (sand and gravel) 1st Mort. 6s[27]	July 16	100	98	100	
United Fuel and Supply Co. (sand and gravel) 6% gold notes[27]	July 16	100	96	99	
United States Gypsum Co. (common)	Sept. 28	20	152½	153	2% quar., $1 ex. Sept. 1
United States Gypsum Co. (preferred)	Sept. 28	100	117	121	1¾% quar. Sept. 30
Universal Gypsum Co. (common)[3]	Sept. 28	No par	12	13	
Universal Gypsum V.T.C.[3]	Sept. 29	No par	13½	14½	
Universal Gypsum Co. (preferred)[3]	Sept. 15	....	70	73	1¾% quar. Sept. 15
Universal Gypsum and Lime Co. (1st 6's, 1946)[3]	Sept. 29	100	96	....	
Union Rock Co. (7% serial gold bonds)[18]	Sept. 25	100	99	101	
Wisconsin Lime and Cement Co. (1st Mort. 6s, 1940)[15]	Sept. 29	100	98½	100	
Wolverine Portland Cement Co.	Sept. 28	10	6½	7	2% quar. Aug. 15

[1]Quotations by Watling, Lerchen & Co., Detroit, Mich. [2]Quotations by Bristol & Willett, New York. [3]Quotations by True, Webber & Co., Chicago. [4]Quotations by Butler, Beading & Co., Youngstown, Ohio. [5]Quotations by Freeman, Smith & Camp Co., San Francisco, Calif. [6]Quotations by Frederic H. Hatch & Co., New York. [7]Quotations by F. M. Zeiler & Co., Chicago, Ill. [8]Quotations by Ralph Schneeloch Co., Portland, Ore. [9]Quotations by A. E. White Co., San Francisco, Calif. [10]Quotations by Lee, Higginson & Co., Boston and Chicago. [11]Nesbitt, Thomson & Co., Montreal, Canada. [12]E. B. Merritt & Co., Inc., Bridgeport, Conn. [13]Peters Trust Co., Omaha, Neb. [14]Second Ward Securities Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois, Chicago. [16]J. S. Wilson Jr. Co., Baltimore, Md. [17]Chas. W. Scranton & Co., New Haven, Conn. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hemphill, Noyes & Co., New York. [20]Quotations by Bond & Goodwin & Tucker, Inc., San Francisco. [21]Baker, Simonds & Co., Inc., New York. [22]William C. Simons, Inc., Springfield, Mass. [23]Blair & Co., New York and Chicago. [24]A. B. Leach and Co., Inc., Chicago. [25] A. C. Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [27]J. G. White and Co., New York.

QUOTATIONS ON INACTIVE ROCK PRODUCTS CORPORATION SECURITIES ON PAGE 74

Editorial Comment

Philosophy of Management

The Institution of Quarry Managers, of Great Britain, has just instituted, through the generosity of one of its wealthy members, the practice of awarding a gold medal, cash prize and fellowship for the best paper presented at its annual conventions. This custom is as old as scientific societies and is designed to promote knowledge by intellectual competition. Centuries have proved its efficacy, and one will find among the prize papers read before the Royal Society, the Institution of Civil Engineers, the American Society of Civil Engineers, and a host of similar scientific societies, some of the most important contributions to our present knowledge of science and engineering. It is a practice that could well be followed by our American trade or business associations in the rock products industries.

Mr. Searle's prize paper on management is published complete elsewhere in this issue, not so much because it is addressed to quarry managers, but because it seems to us an excellent summary of the whole theory and philosophy of present-day management, whether applied to the quarry industry of the British Isles, or to a sand and gravel operation in the state of Maine, U. S. A.

However, it is doubly interesting, coming from Great Britain, where we Americans have been led to believe the caste system has always more or less interfered with effective management. Be that as it may, Mr. Searle has certainly given, within the limits of a comparatively brief paper, the prime essentials of successful management, and has emphasized the increasing importance of efficient management to industrial enterprises.

We cannot agree with Mr. Searle that we are nearing the end of great improvements in machinery. Our own brief ten years' experience with the rock products industries alone seems proof enough that there never can be an end to great improvements in machinery. For example, take the recent development in conveying portland cement. The introduction of pneumatic handling was revolutionary, in spite of the fact that the screw conveyor and the belt conveyor had been perfected and considered the last word in material-handling machinery. We have faith that other kinds of equally revolutionary and efficiency-producing machinery are still to be brought forth.

Damaging Misinformation

A leading contractor's paper said recently:

> One of the conditions in ——— that has made it difficult for outside contractors to enter and compete with local concerns is the fact that building operations are more difficult to carry on in that city. Concrete materials are exceptionally poor, good stone being hard to get and sand being of indifferent and constantly changing quality. To make fair concrete from such materials requires exceptional vigilance, and the local contractors that have grown accustomed to fighting with these materials seem to have better success than outside firms who are accustomed to the use of better aggregates.

This is an example of the sort of "news" that may do a great deal of harm to producers of aggregate. The locality referred to is one that the editors of Rock Products know well. Two of the important crushed stone plants of the country are located there and the quality of their product is unquestionably of high grade. Good sand is admittedly scarce in this locality, but at least one plant produces as good a concrete sand as is to be found in the state and plenty more may be had from shippers within a reasonable distance. It is true that there has been a considerable production of inferior aggregates which has been sold at a low price, but the contractor who buys this stuff, only to find that he cannot make good concrete from it, has only himself to blame.

Efficiency in Fertilizer Manufacture

The fertilizer industry has been deflated in several ways, to the advantage of itself and those whom it seeks to serve. The deflation which it postponed as long as possible, and took the hardest, was of course the price adjustment after the war, when it was caught with large stocks of materials which rapidly declined in value, reaching their bottom point along with the disastrous fall of the cotton market in 1920. Then losses were reluctantly charged off, clearing the atmosphere and making way for other changes of greater and more lasting importance.

Perhaps chief of these was the complete deflation—or "debunking," if we may call it such—of the mystery of fertilizer formulas. The rapid advance of soil science made it impossible to induce a blind faith in fertilizer as a magic hocus-pocus or witch's powder. The agricultural colleges fortunately gained the ascendant, and the fertilizer manufacturers found that their salvation lay in working with the scientists and fitting their analyses to the needs of the soil rather than to the supplies of such scrap materials as might be available.

Another important result of this contact has been a growing recognition on the part of the fertilizer industry of the role which may be played in agriculture by our natural minerals.

The scarcity and consequent increase in price of organic materials, as their value for other uses has become known, has had something to do with this; but it can also be attributed in great measure to the more intimate contact with unprejudiced specialists in matters of soil fertility. Even if the mineral is classed technically as a carrier, it still has advantages from the standpoints of both analysis and sales talk over a filler of entirely inert material. Sometimes, too, the principal virtue of the fertilizer is a limestone "filler."

QUOTATIONS OF INACTIVE ROCK PRODUCTS SECURITIES

Stock	Date	Par	Price bid	Price asked	Dividend rate
Coplay Cement Mfg. Co. (common) (4)	Dec. 16	....	12½	....	
Coplay Cement Mfg. Co. (preferred) (1)	Dec. 30	....	70	....	
Eastern Brick Corp. 7% cu. pfd.) (1)	Dec. 9	10	40c	....	
Eastern Brick Corp. (sand lime brick) (common) (1)	Dec. 9	10	40c	....	
Edison Portland Cement Co. (common)4	Sept. 11	50	20c	....	
Edison Portland Cement Co. (preferred)	Nov. 3	50	17½c(x)	....	
Iroquois Sand & Gravel Co., Ltd. (2 sh. com. and 3 sh. pfd.) (1)	Mar. 17	....	$12 for the lot	....	
Lime and Stone Products Co. (1100 sh. pfd., $10 par and 700 sh. com., $10 par)	Feb. 10	....	$66 for the lot	....	
Missouri Portland Cement Co. (serial bonds)	Dec. 31	....	104¾	104¾	3¼% semi-annual
Olympic Portland Cement Co. (g)	Oct. 13	....	....	£1⅝	
Phosphate Mining Co. (1)	Nov. 25	....	1@5	....	
River Feldspar and Milling Co. (50 sh. com. and 50 sh. pfd.) (1)	June 23	....	$200 for the lot		
Rockport Granite Co. (1st 6's, 1934)2	Aug. 31	....	90	....	
Simbroco Stone Co. (pfd.)	Dec. 12	....	....	....	$2 Jan. 1
Southern Phosphate Corp.6	Sept. 15	....	1¼	....	
Vermont Milling Products Co. (slate granules) 5 sh. pfd. and 1 sh. com. (2)	Dec. 30	....	$1 for the lot	....	
Wabash Portland Cement Co.1	Aug. 3	50	60	100	
Winchester Brick Co. (preferred) (sand lime brick) (5)	Dec. 16	....	10c	....	

(g) Neidecker and Co., Ltd., London, England. (1) Price obtained at auction by Adrian H. Muller & Sons, New York. (2) Price obtained at auction by R. L. Day and Co., Boston. (3) Price obtained at auction by Weilepp-Bruton and Co., Baltimore, Md. (4) Price obtained at auction by Barnes and Lofland, Philadelphia, Pa. (5) Price obtained at auction for lot of 50 shares by R. L. Day and Co., Boston, Mass. (x) Price obtained at auction by Barnes and Lofland, Philadelphia, on November 3, 1925. (6) Price obtained at auction by Wise, Hobbs and Arnold, Boston, Mass.

Pennsylvania-Dixie Cement Stock and Bonds Offered

THE National City Co., Lehman Brothers, Cassatt & Co., Mitchell, Hutchins & Co., Hemphill, Noyes & Co., Hornblower & Weeks, Caldwell & Co., Bond & Goodwin & Tucker, Inc., are offering at 99½ and interest, to yield 6.05%, $13,000,000 Pennsylvania-Dixie Cement Corp. first mortgage sinking fund 6% gold bonds, Series A, to be dated September 15, 1926; to mature September 15, 1941; authorized issue, $20,000,000.

Coupon bonds in denominations of $1,000 and $500, registerable as to principal only. Interest payable March 15 and September 15 without deduction for any Federal income tax not exceeding 2%. Redeemable in whole or in part at the option of the corporation on any semi-annual interest date prior to maturity, upon 30 days' prior notice at 105 if redeemed on or before September 15, 1931, at 103 thereafter and on or before September 15, 1936, and thereafter at principal amount thereof plus a premium of ½% for each year or portion of a year between the date of redemption and maturity. Principal and interest payable in United States gold coin at the head office of the National City Bank of New York, trustee.

The corporation will agree to reimburse to respective owners of bonds of Series A, resident in the respective states, the amounts of the following taxes which may be paid with respect to such bonds or the income therefrom: The four mills tax in Pennsylvania; any securities taxes in Maryland, not exceeding, in the aggregate, 45 cents on each $100 of the assessed value of the respective bonds in any year; any personal property or exemption tax in Connecticut, not exceeding 4/10ths of 1% on the face amount thereof in any year; any property tax in California, not exceeding 4/10ths of 1% of the assessed value thereof in any year; any intangible personal property tax in the District of Columbia not exceeding 5/10ths of 1% of the assessed value thereof in any year; any property tax in Tennessee, not exceeding 50 cents on every $100 of the assessed value thereof in any year; any Massachusetts income tax, not exceeding 6% of the interest thereon in any year; and any ad valorem state tax in Kentucky, not exceeding 50 cents upon each $100 of assessed value thereof in any year, but, in each case, only upon application made in the manner provided in the said mortgage.

The following information has been summarized from a letter of Richard Hardy, chairman of the corporation:

Pennsylvania-Dixie Cement Corp. has been incorporated under the laws of the state of Delaware, to acquire the business and properties of the Pennsylvania Cement Co., Dexter Portland Cement Co., Dixie Portland Cement Co. and Clinchfield Portland Cement Corp.

All of these companies have been in successful operation for periods of 15 to 25 years and produce cement at costs which are among the lowest of any plants in the country.

Properties.—Upon the acquisition of these properties, the corporation will become one of the larger companies in the cement producing industry, and will own seven plants with an aggregate productive capacity of 10,000,000 barrels of cement per annum. In addition, the corporation, through subsidiaries, will produce and sell sand, gravel, limestone, tile and other cement products.

The location of the cement plants and their present annual capacity (in barrels), as reported by Ford, Bacon & Davis, Inc., and Ellis Soper, are shown below:

Location	Annual capacity
Nazareth, Penn., plant No. 1	1,300,000
Nazareth, Penn., plant No. 2	1,100,000
Bath, Penn.	1,940,000
Portland Point, N. Y.	1,060,000
Richard City, Tenn.	2,000,000
Kingsport, Tenn.	1,500,000
Clinchfield, Ga.	1,100,000
Total	10,000,000

Each of the above plants constitutes a complete unit with large nearby reserves of high-grade raw materials and efficient equipment for the quarrying, grinding and burning operations incident to the manufacture of portland cement. All of the mill equipment, including the crushers, pulverizers and large rotary kilns, is electrically driven, power being secured in part from turbo-generator installations using waste heat from the kilns, and in part under favorable contracts with electric power companies.

Earnings.—Each of the four companies whose assets are being acquired has reported a profit for each of the past 13 years. For the three years ended Dec. 31, 1925, and the 12 months ended July 31, 1926, the combined earnings of the properties to be acquired, after eliminating certain bonuses and special compensation now discontinued, have been reported by Price, Waterhouse & Co. as follows:

The first mortgage bonds will be secured, in the opinion of counsel, by a direct first mortgage on all the lands, buildings, machinery and equipment (with a few unimportant exceptions) of Pennsylvania-Dixie Cement Corp. and by the pledge of the stock of two small subsidiaries. These properties have been appraised recently by Ford, Bacon & Davis, Inc., as having a sound value based upon reproduction cost less depreciation, which, together with working capital, aggregates over $32,000,000, and a commercial value, including working capital, in excess of $40,000,000.

Each of the four companies whose assets are being acquired has reported a profit for each of the past thirteen years. For the three years and seven months ended July 31, 1926, the average annual net earnings, available for interest, after depreciation and depletion, and after eliminating certain bonuses and special compensation now discontinued, as reported by Messrs. Price, Waterhouse & Co., have been $4,269,806 or 5.47 times the interest charges on the Series A first mortgage bonds being issued, and for the 12 months ended July 31, 1926, such net earnings amounted to $5,087,614 or over 6½ times the interest requirements on these bonds.

Preferred Stock Offering.—The above bankers are offering at 99 flat, $7,215,300 series A, 7% convertible cumulative preferred stock (par value $100). Dividends on this issue will accumulate from Septem- 15, 1926. Redeemable as a whole or in part on any dividend date on thirty days' prior notice at 110 and accumulated dividends. preferred as to assets to the extent of $110 per share and accumulated dividends in case of voluntary liquidation, and to the extent of $110 per share and accumulated dividends in case of voluntary liquidation, and to the extent of $100 per share and accumulated dividends in case of involuntary liquidation. Dividends exempt from the present normal Federal income tax.

Series A cumulative preferred is convertible at any time at the option of the holder thereof into common stock of the corporation at the rate of 1½ shares of common stock for each share of cumula-

EARNINGS OF THE COMBINED COMPANIES, 1923-1926

Year ended—	Dec. 31 '23	Dec. 31 '24	Dec. 31 '25	July 31 '26
Net earnings*	$4,226,682	$4,696,386	$5,702,599	$6,101,582
Depreciation and depletion	662,922	741,878	938,128	1,013,968
Net earnings†	3,563,760	3,954,508	4,764,471	5,087,614
Income available for preferred divs.‡	2,407,952	2,745,950	3,446,567	3,726,086
Income available for com. divs	1,497,952	1,835,949	2,563,567	2,816,086

*Available for interest, before depreciation and depletion.
†Available for interest after depreciation and depletion.
‡After deducing interest charges of $780,000 on the $13,000,000 of bonds to be outstanding and Federal taxes at 13½%.

tive preferred stock Series A so converted.

CAPITALIZATION

	Authorized	Presently to be outstanding
First mortgage bonds, due 1941	$20,000,000	
Series A, 6%		$13,000,000
Cumulative preferred stock	20,000,000	
Series A, convertible 7%		13,000,000
Common stock (no par value)	1,000,000 shares*	400,000 shares*

*Including 195,000 shares reserved for conversion of Series A preferred stock.

Common Stock Offering—The bankers are also offering at $43 per share, 300,000 shares of common stock.

Earnings and Assets—The net income available for dividends after eliminating certain bonuses and special compensation now discontinued and after deducting interest charges on the bonds to be outstanding and federal taxes at the rate of 13½%, for the period of three years and seven months ended July 31, 1926, as reported by Messrs. Price, Waterhouse & Co., has averaged $3,018,682, or over 3.3 times the dividend requirements on the cumulative preferred stock to be outstanding. For the twelve months ended July 31, 1926, such net income amounted to $3,726,086, or more than four times the preferred dividend requirements, and after deducting the dividend requirements on the cumulative preferred stock to be outstanding, such balance of net income is equivalent to $7.04 per share on the 400,000 shares of common stock to be outstanding.

The combined earnings of the companies to be acquired by Pennsylvania-Dixie Cement Corporation, before deduction of special compensation and certain bonuses to be discontinued, and after depreciation, depletion, and all prior charges based on the new capitalization, including federal income taxes at the rate of 13½%, as certified by Messrs. Price, Waterhouse and Co., public accountants, have been as follows:

Year Ended	Earnings (as above)	Earnings per common share (as above)
December 31, 1923	$1,497,952	$3.74
December 31, 1924	1,835,949	4.59
December 31, 1925	2,536,567	6.34
July 31, 1926	2,816,086	7.04

The number of barrels of cement sold during the twelve months ended July 31, 1926 represent increases of 4.3%, 14.6% and 31.2% respectively over the three preceding calendar years 1925, 1924 and 1923. During this period the annual capacity of the properties was enlarged by more than 3,000,000 bbl.

The consolidated balance sheet, as of July 31, 1926, of the properties and business to be acquired by the corporation, after giving effect to the transactions, including financing, incident to such acquisition, as prepared by Messrs. Price, Waterhouse & Co., shows current assets of over 4.9 times current liabilities, and net current assets of $6,024,865, or over 60c per barrel of capacity. After deducting all liabilities, the net assets available for the cumulative preferred stock amount to $19,247,702, and based upon the commercial value of the properties, as appraised by Ford, Bacon & Davis, Inc., such net assets available for the cumulative preferred stock amount to over $27,900,000.

CONDENSED CONSOLIDATED BALANCE SHEET JULY 31, 1926

[Of the combined properties and business to be acquired after giving effect to the transactions, including financing, incident to such acquisition.]

Assets—	
Fixed assets*	†$26,053,446
Cash	3,370,445
Notes and accounts receivable (net)	1,679,389
Due from officers and employes	63,399
Inventories	2,452,967
Investments	120,100
Deferred charges	113,057
Total	$33,852,803
Liabilities—	
7% cumulative preferred stock	$13,000,000
Common stock (400,000 shares, no par)	4,000,000
First mortgage series A gold bonds	13,000,000
Accounts payable	464,371
Accrued wages, taxes, etc.	341,807
Reserve for Federal taxes	735,157
Miscellaneous reserves	63,766
Surplus at organization	2,247,702
Total	$33,852,803

*At reproduction cost less depreciation as appraised by Ford, Bacon and Davis, Inc., as of June 30, 1926, adjusted to July 31, 1926: Land and mineral reserves, $2,859,458; buildings and equipment, $27,775,545; (less depreciation, $4,581,557), $23,193,988.

†Ford, Bacon and Davis, Inc., have appraised the commercial value of these properties at $34,762,000.

Dividends.—It is expected that dividends on the common stock will be initiated in the near future at the rate of $3.20 a year.

The management of the Pennsylvania-Dixie Cement Corp. will be composed of men identified with the predecessor companies.

Universal Gypsum and Lime Bonds Offered

TRUE-WEBBER AND CO., Chicago, Peters Trust Co., Omaha, and Porter and Co., Boston, are offering at 96 and interest to yield about 6.35%, $2,000,000 Universal Gypsum and Lime Co., Chicago, first mortgage 6% sinking fund gold bonds. Dated September 1, 1926, and due September 1, 1946. Redeemable as a whole or part on any interest date on 30 days' notice at 105 and interest. Equitable Trust Co., New York, trustee.

The following information is summarized from a letter of W. E. Shearer, president of the company:

Company.—The Universal Gypsum and Lime Co., the second largest company in its line, will be a consolidation of the Universal Gypsum Co. and subsidiaries, and Palmer Lime and Cement Co. The company manufactures and distributes a complete and diversified line of gypsum and lime products. Both gypsum and limestone, or products manufactured from them, are sold for use in agriculture, in the manufacture of portland cement, for chemical and industrial uses and very largely in the building industry. Among the many important products are wall board, plaster board, building tile, both lime and gypsum plaster and a cellular gypsum insulation. The company owns and/or operates three gypsum deposits, four limestone quarries and seven modern plants located at Fort Dodge, Iowa; Akron and Batavia, N. Y.; Rotan, Texas; York, Penn.; and Oranda, Va. The products of the company are advantageously distributed in all of the territory east of the Rocky mountains.

Security.—These bonds will constitute the company's only funded debt and will be secured, in the opinion of counsel, by a direct first (closed) mortgage on all of the real estate, plants, machinery, equipment and other fixed assets of the corporation, excepting certain minor equipment located at the company's plant in Pennsylvania. Fixed assets as shown by the balance sheet of the company as of June 30, 1926, were $4,981,507. Net current assets as of that date were $1,809,684. Total net assets less reserves and exclusive of good will and other intangibles were $8,300,869, equivalent to over $4100 for each $1000 bond.

Purpose of Issue.—The proceeds of the present issue of bonds will be used to effect a substantial saving in interest charges through refunding the existing funded debt of the company which bears 7% interest, to supply the company with additional working capital and to build a modern plant on its Brooklyn property, which is favorably situated at tidewater on Maspeth Creek and on the main line of the Long Island railroad.

Earnings.—The company has operated at a profit since its organization in 1922. In each of the years ended December 31, 1925, and August 31, 1926, the combined properties reported net earnings of over 4½ times maximum annual bond interest charges. The company anticipates that net earnings for the year ending July 1, 1927, after depreciation, depletion and taxes, will be $1,225,000. (Resulting from economies to be effected by the merger; benefits that will accrue to the company by the sale of gypsum to Palmer customers and lime to Universal customers; after giving effect to a full year's operation of the important additions made to productive capacity in 1925, and through a nominal increase in business.) The completion of the Brooklyn plant should bring net earnings in 1928 to $1,500,000, or 12½ times maximum interest requirements.

The entire company has operated at a profit since its organization in 1922. For the year ended Dec. 31, 1925, the combined properties reported earnings as follows:

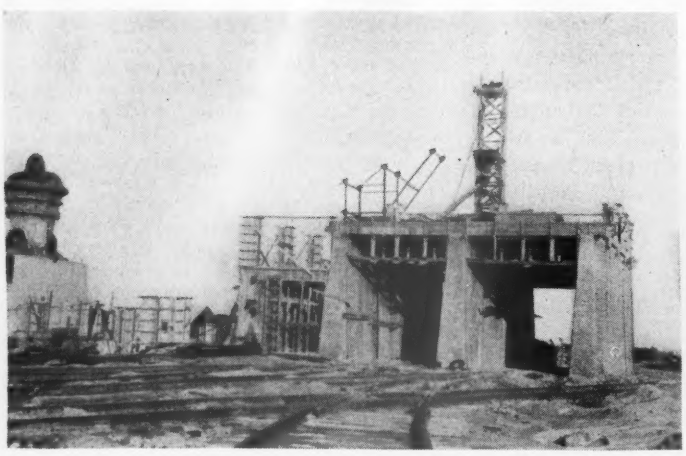
Gross sales	$4,687,952
Operating expenses	4,139,644
Net income applicable to interest charges before depreciation, depletion and federal taxes	$ 548,308
Annual interest on $2,000,000 first mortgage bonds (this issue)	120,000
Balance	$ 428,308

A preliminary report by the company's auditors indicates that earnings for the year ended Aug. 31, 1926, were in excess of those for the year 1925.

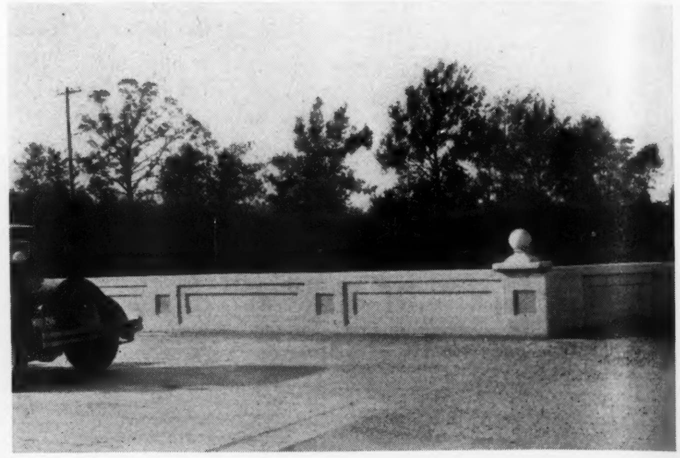
Sinking Fund.—The mortgage will provide for a minimum sinking fund of $100,000 per year or 10% of the net earnings, whichever is larger. The sinking fund will retire all of these bonds at or before maturity.

Imperial Gypsum Co. Dissolved

PERMISSION was granted the Imperial Gypsum Co. by the California corporation commission to withdraw and pay to its stockholders $180,238.05. The company was also granted dissolution, and the board of directors was increased to nine.



New plant under construction at Monroe, Mich., by the France Stone Co.



New concrete bridge recently built by the France Stone Co. at their Silica, Ohio, quarry

Some Big New Rock Products Operations in Ohio and the Virginias

France Stone Has Mining Engineer and Geologist — Two New Gravel Plants at Columbus—Rock Products Resources of Virginia

By Edmund Shaw
Editor, Rock Products

OHIO is a great producer of crushed stone and sand and gravel and two Ohio companies probably hold the record for production of these commodities. The France Stone Co. of Toledo, with a yearly output between 4,000,000 and 5,000,000 tons of crushed stone, and the Greenville Gravel Corp., which will produce more than 6,000,000 tons this year, are the companies referred to. Neither confines its operations to Ohio, but a very large part of the production of each comes from that state. The France company is operating 16 of its quarries at present, two in Indiana, one in Michigan and the remainder in Ohio. The Greenville company is operating 12 plants, half of which are in Ohio and the other half in Michigan and Indiana.

A Quarry Geologist

Operations of both companies were visited shortly before this was written. The occasion of the visit to the France company was to learn something of the work of its geological department. It is new for a crushed stone company to employ a geologist although the somewhat similar industries, mining and oil drilling, have long found geologists to be not only useful but necessary. Of course there has been a great deal of prospecting and other geological work done by crushed stone producers, but it has been done by the job and not continuously. The France company's reason for establishing a geological department as explained by Howard E. Bair, the general manager, was that the information such a department could secure was wanted at all times. Such part of the information as could be furnished by the practical men at work on the job needed to be correlated by one familiar with the geology of the whole locality. And the purely theoretical geologist who might be called in did not have the practical knowledge of individual operations that was necessary to apply his work to actual crushed-stone production.

Testing screens with which every plant of the France Stone Co. has been recently equipped

Mr. Bair, as everyone who has attended the conventions of the National Crushed Stone Association knows, is very much interested in the crushed-stone industry outside of the operations which he himself directs, and his opinions are worth the consideration of other producers. He believes the crushed-stone producer needs education in the necessity of producing a really high grade product. He thinks that the crushed-stone producer has been his own worst enemy in that he has failed to stress the advantages of his product as he should when it is brought into competition with other materials. To do this effectively he must know how to make a product that is beyond reproach. It is the policy of his company to make such a product, and the establishment of a geological department is in line with this policy.

Every plant operated by the France Stone Co. has been provided with a set of steel-framed testing screens with openings from 3 in. down. These are set on rockers so that the sample can be easily shaken through. It does not take long to make a screen test, and those in charge of plants see to it that the plant products have the proper grading.

A laboratory is maintained for making physical tests and chemical analyses of samples of the product. It is equipped with all

the testing machines found in state highway laboratories except those for testing concrete. An Olson machine for this work is soon to be added. The laboratory is in charge of Herbert F. Triege, who was with the Missouri highway department before he took this position. Arthur C. Avril has charge of the geological work and both are graduates of Ohio State University. Mr. Triege has

Rough stone from the quarry and old rails are used to build the Bellevue, Ohio, plant

obtained the degree of Ph. D. by post-graduate work in silicate chemistry.

Recently the France company made one of its regular investigations of production methods and discovered some things of general interest. One was that at a certain plant it was impossible to make a product meeting the highest specifications without reducing the daily tonnage by 400 tons. The reduction was made. At another plant it was found that by increasing the size of screen opening in one of the intermediate screens both a better graded product and a greater output would result; so in one plant an increased production did what a decreased production did in another.

Rebuilding Monroe Plant

The company is building a new plant at Monroe, Mich., to take the place of a plant that was destroyed by fire less than a year ago. The primary crusher, a No. 21 Allis-Chalmers gyratory, has been salvaged and placed on a concrete foundation. In the old operation this crusher was placed down in the quarry and the crusher discharge conveyed to a screening plant on the railroad track level above. In the new plant both primary crusher and screening (and recrushing) plant will all be on the track level. A 60-in. Allis-Chalmers pan conveyor will be installed to take the crusher discharge to the two main screens. The oversize from these screens will be chuted to a No. 7½ Allis-

New plant of the Greenville Gravel Corp. at Columbus, Ohio

Chalmers and a No. 8 Austin crusher and from these it will be elevated to the same screens. There will be a vibrating screen of a type not yet decided upon to make the finer sizes of stone.

The flow sheet is simple but it is the result of a great deal of study based on the experience of the company with the many plants it has built and operated. In part the flow sheet is due to John Parlette, who has been with the company for many years. The engineering work is all being done by the company's own engineering department.

The construction is all steel and concrete. Practically everything in the structure will be concrete to the top of the bins and a steel super-structure above the bins will house the machinery. The capacity will be 2,500 tons per day. O. R. Greeno is superintendent.

New Greenville Gravel Plant

The plant of the Greenville Gravel Corp. which was visited is the new one at Columbus, Ohio. Like all the other plants designed and built by this company (which has designed several very well-known plants in this country) it is an example of good sound engineering applied to sand and gravel production. Except for the bins and sand collector everything above the foundations is of structural steel covered with galvanized metal siding.

This is a dredging operation and a 15-in. "Ansco" pump direct-connected to a 350-hp. General Electric motor does the excavating. The plan followed is the same as that of the company's operation at Urbana, Ohio. The dredge pumps through a short pipe line to a concrete sump provided with an overflow. Below this sump is a concrete-lined tunnel into which two skips, running in balance, are alternately lowered. The skips are filled from gates in the roof of the tunnel that open into the sump above.

This is one of the most ingenious methods of dewatering the discharge of a dredge and

Dredge with 15-in. pump at Columbus plant of Greenville Gravel Corp.

getting it to the screening plant that the writer has seen. It was invented and worked out by F. C. Coppock, president of the company. One of its advantages is the ease with which it may be accommodated to larger production. At present the capacity of the Columbus plant is 75 cars per day, but Mr. Coppock, whom I met at the plant, told me he had just made arrangements to increase it to 100 cars per day. Practically all that had to be done to get this increase was to install larger skips.

The design of this plant was by Frank Welch, chief engineer of the company, and the screening, conveying and elevating machinery was made by the Greenville Manufacturing Co. and the Allied Belting Co., which are closely allied with the Greenville Gravel Corp.

New Arrow Company Plant

Columbus is to have another sand and gravel plant, for which the Arrow Sand and Gravel Co. has just completed plans. Stephan Stepanian, the manager, who is an engineer by profession, has designed the plant. He told me that a dragline with a 6-yd. bucket would be used to excavate the material, which would be hoisted to the washing and screening plant with two 6-ton skips running in balance. There are to be four crushers of the reduction type, as the ground contains a fair proportion of cobbles and small boulders. There will be a scalping screen and a set of Dull conical screens (Link-Belt) to make the final separation of the products. The daily capacity will be 3,000 tons.

The entire structure will be of steel and concrete. A feature of this plant which gives it a remarkable advantage for local shipments is its nearness to the city, as it is only 1 1/10 miles from the center of Columbus. The deposit is on the bank of the Scioto river but it is not a river deposit; it is of glacial origin.

New Southern Crushing Plant

This letter is written from Saltville, Va., in the southern part of the state where the Mathieson Alkali Works has a large plant. Almost everyone around here gets his living in some way from a rock products industry. The alkali company has a quarry here and burns lime as a part of its process. The United States Gypsum Co. has a large plant at Plasterco, one and a half miles distant. On the other side of town, four miles away, is the plant of the Southern Gypsum Co. and at Marion, which is perhaps 15 miles distant, there are two plants for making crushed stone and agricultural limestone. There are other operations up the valley of the New river at some distance from here. George Patnoe, well known as an engineer in the rock products industries, is building the limestone crushing and washing plant for the Mathieson Alkali Works at Saltville.

Coming down from Columbus on the Norfolk and Western one could see a limestone bluff from the window at any time after the train had passed through the coal mining regions. As is everywhere the case in the southern Appalachians "the country is set on edge" so that the exposure represents many geological formations. There will be much wealth taken in the future from these hills for the mineral resources are enormous.

One rock products industry I did not find represented here is the sand and gravel industry. There are no gravel beds to be seen and the swift mountain streams run over beds of clean limestone. Sand has been brought in for concrete work from Norfolk, and, I am told, costs about $5 a ton on the track here. So limestone screenings are used in its place as far as possible.

Heller Brothers To Open New Crushing Plant Near Calexico

ANNOUNCEMENTS have been made by Heller Brothers, contractors and operators of rock-crushing plants in many parts of California, that they will build a $200,000 plant at Sugar Loaf Mountain, in the west end of the valley.

The rock produced will be used in the building of the new border highway, from the Yuma highway, Calexico to Seeley.

Quarry and new crushing plant of the Mathieson Alkali Works, Saltville, Va.

Applications of Diesel Engines in the Rock Products Industries

Types of Diesel-Engine Drives—Characteristics of Diesel Engines—Study of Load Conditions—Fuel Consumption in Terms of Plant Capacity—Lubricating Oil Consumption—First Cost of Installations

By R. H. Bacon
Diesel Engine Division, Fairbanks, Morse & Co., Chicago, Ill.

THE ROCK PRODUCTS INDUSTRY offers such unusual opportunities for reducing the cost of power with Diesel engines that the application of these units is developing at a rapid rate in this field. As compared with steam-plant operation, the Diesel engine has many advantages. It easily cuts the fuel cost in half, and as no firemen are required it reduces the labor cost. The boiler and furnace maintenance problem is also eliminated.

Diesel engines have features which make them particularly attractive for this field. They are simple to operate and there is very little to go wrong. Maintenance costs are exceptionally low, and dependability in operation is assured.

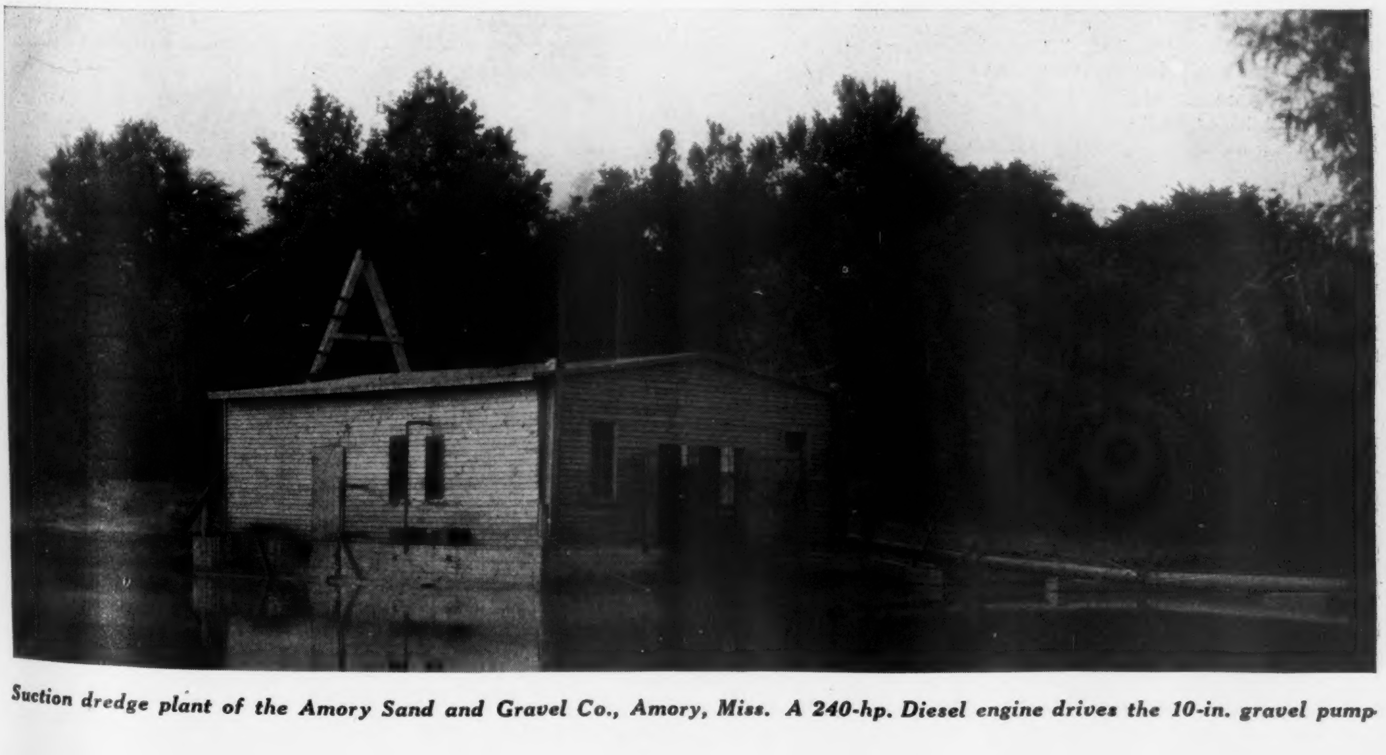
The power required to drive rock crushers, conveyors, screens, drag-line buckets, elevators, hoists and pumps may fluctuate widely. The resulting peak loads cause purchased power to be rather expensive when the contract is based on demand charges.

THIS article forms an interesting and helpful sequel to the article on "Diesel Engines for Rock Products Plants" by the same author in our issue of March 7, 1925. The previous article, referred to, contains a description of the modern Diesel engine in detail. The present article describes some recent applications to our industries.—The Editors.

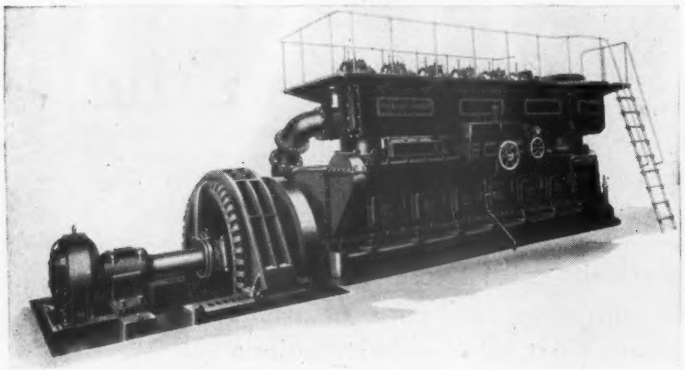
It is usually necessary to over-motor drives of this type in order to provide the torque to start these machines under low temperature conditions. This means a low power-factor load, and also increases the expense of purchased power, particularly where rates include a power-factor penalty clause.

Types of Diesel Engine Drives

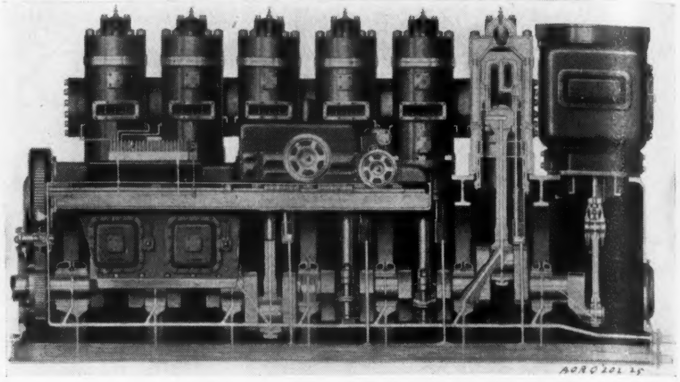
Since the Diesel engine lends itself to a wide variety of drives it is possible to lay out many combinations of units and of drives. The engine with direct-connected alternator is, of course, a type of unit which is coming into widespread use for general power plant service. The engines can also be equipped with belt pulleys or friction-clutch pulleys. The friction-clutch pulley is used where the engine is belted to a machine which has a high starting torque. The engines may also be direct connected by flexible couplings to machines that start under light load; in the case of direct connection to machines that start under heavy load, friction-clutch couplings are used. It is also possible to arrange various drive combinations such as direct connection of the engine to an alernator with a clutch pulley placed beyond the outer alternator bearing. Another combination is to use a belt drive to the alternator and then a friction-clutch coupling on the extension shaft for direct connection to the particular machine which is to be driven.



Suction dredge plant of the Amory Sand and Gravel Co., Amory, Miss. A 240-hp. Diesel engine drives the 10-in. gravel pump



New 720-hp. Diesel engine of the two-cycle, single-acting, port scavenging, airless-injection type



Diesel engine with operating mechanism and one cylinder exposed to show method of control

Characteristics of the Diesel Engine

In making a study of the application of Diesel engines to any set of load conditions it should be kept in mind that the Diesel engine has certain fundamental operation characteristics that have a general effect on its application.

First: Diesel electric-generating sets parallel nicely, making it possible to install several units to take care of the load if the characteristics of the load are such as to make this economical. The multiple units add to the flexibility of the plant and increase the reliability of operation.

Second: The fuel efficiency of the small engines is practically the same as for larger ones. This makes it possible to take advantage of the multiple unit idea without loss in over all plant efficiency. It also makes it possible to add units from time to time as the power requirements increase with a result that the plant efficiency may even be bettered instead of being lowered as is the case with the steam engine or turbine.

Third: The fuel consumption curve for the Diesel engine is practically flat through the range from half to full load. For the lighter loads the fuel consumption per brake horsepower output increases rapidly as is also the case with steam engines or turbines. In laying out a plant this characteristic should be carefully considered as the total fuel consumption will be lowered if the Diesel units are so fitted to the load that no engine is operated at less than half load.

Fourth: The lubricating oil consumption is practically constant for any particular size of unit; that is, it does not vary with the load.

Study of Load Conditions

In studying the characteristics of the load, it is advisable to use graphic charts plotted from hourly readings. In the case of the plant that is already in operation it is usually quite easy to plot such a chart and in the case of the new plant it is usually possible to estimate the requirements during the daily cycle of operation.

It is general practice to study the application of Diesel engines from the brake-horsepower-hour standpoint. Fuel consumption guaranties are based on brake-horsepower-hours so that if the charts are plotted in horsepower they tend to simplify the study.

These charts often show that by changing certain operations in an industrial establishment, it will be possible to reduce the peak loads materially, thereby decreasing the size of engine required and increasing the running load factor which in turn will lessen the fixed charges per unit of power. Such charts will also permit a study to be made of the sizes of units which should be applied and will make it possible to figure the operating economy of several combinations.

Fuel Consumption in Terms of Plant Capacity

Fig. 1 shows the fuel consumption curves for a plant equipped with from one to four Diesel engines. If one engine is used the total fuel consumption is based on the normal fuel guaranty curve for the engine. If two units are used, then when the load on the plant has reached 50% of its total load, or the total capacity of one engine, the other engine is started up and both engines are operated at 50% load. In this case, as will be seen from the curves, the fuel consumption is the same as if the one engine were operating at 50% load. The other curves show the effect of putting in three and four units. In each case the fuel consumption for those loads below 50% of the plant capacity, is much less than would be the case if one unit were installed.

These curves are based on guaranteed fuel consumption and are typical manufacturers' guaranty curves. This does not mean that Diesel engines will not operate on a lower fuel consumption per brake-horsepower-hour than is indicated by these curves. Many installations show a fuel economy at full load as low as 0.42 lb. per brake-horsepower-hour; but the full-load consumption of 0.46 lb. per brake-horsepower-hour, as shown on these curves, is conservative in order to permit the use of a wide range of fuel oil.

It has been found from long experience that a well designed Diesel electric plant will produce 10-kw.-hrs. per gal. of fuel oil. In the case of a mechanical drive, where the average load on any one engine is more than 50% of capacity, a gallon of fuel oil will produce 15 brake-horsepower-hours.

The cost of oil fuel varies from about 3½ cents to 8 cents per gallon, depending on the section of the country in which it is bought

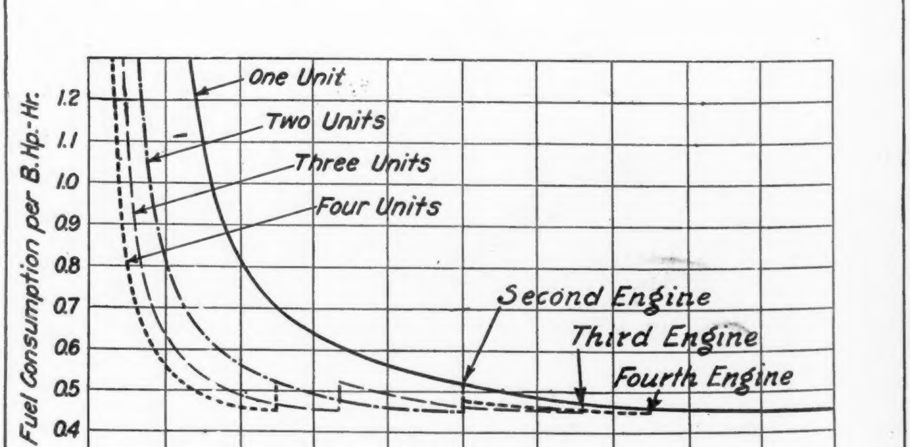


Fig. 1.—Fuel consumption curves for plant equipped with from one to four Diesel engines

and depending on the quantities purchased. The average price for a large number of plants has been found to be 5 cents per gallon.

Lubricating Oil Consumption

The next item of cost of operation to be considered is the lubricating oil consumption. While this is necessarily higher for a Diesel engine than for a steam turbine or engine it is no longer a very important item in the cost of operation, for the reason that in recent years Diesel engines have been greatly improved in this respect. A conservative guaranty on lubricating oil is 2000 hp.-hr. per gal. or 1200 rated kw.-hr. per gal. This is the total oil used in all parts of the engine, no grease or other lubricant being required.

Labor cost is an item which is often greatly over-estimated in considering the Diesel engine plant. A study of a large number of plants has shown that one man on each shift can operate a Diesel engine plant equipped with three engines, and the labor cost for such a plant seldom exceeds $5000 per year. This is divided up between an engineer and two watch engineers.

Another operating item which should be allowed for in a well-managed plant is the cost of maintaining the plant in good operating condition. The best of machinery requires the renewal of parts as the years go by. It has been the experience of owners of Diesel plants that this item is very low. Many plants, however, set aside a definite percentage of the cost of equipment to cover such work. Experience has shown that 2% is more than ample for this purpose.

First Cost of Diesel Plant

The cost of a Diesel engine plant is subject to a number of variables such as freight, foundations, type of building, fuel storage and accessory equipment. For estimating purposes the installed cost of a Diesel engine and its accessories can be taken at $75 to $110 per horsepower.

Where the engine is used for a mechanical drive and a new building or addition is not required, the cost ordinarily will not be over $75 per horsepower. Where an electrical plant of two or three units is to be installed the the cost ordinarily will range from $85 to $110 per horsepower, dpending on the size of the units, type of switchboard, building, etc.

In making a study of power costs it also is necessary to consider the interest on the investment, depreciation, insurance and taxes, all of which are commonly listed under fixed charges.

It is necessary to consider this subject of fixed charges on a fair and unprejudiced basis. It is very easily possible to so load up a plant with fictitious fixed charges that all of the gain through operating economy is offset. The advocates of purchased power are often inclined to stress the fixed charges, since that is the only possible way in which the economy of the Diesel engine generating plant can be overcome.

For the average plant the total fixed charges may be considered as: Interest 6%, sinking fund 2.72%, taxes 1.5% and insurance 1.5%, or a total of 11.72%.

With the above figures in mind it is a comparatively simple matter to obtain a fairly good estimate of what Diesel power will cost. Assume for instance that a plant is to be equipped with two 180-hp. Diesel electric sets to supply power for a quarry operation. If such a plant operated 24 hr. a day for 365 days it would produce approximately 1,900,000 kw. hr. If the plant operated on a 50% yearly plant factor, it would produce 950,000 kw. hr. With a production of 10 kw. hr. per gal. the total fuel consumption would be 95,000 gal. which at a cost of 5 c. per gal. would total $4750.

The lubricating oil consumption would be approximately 950,000 divided by 1200 or 790 gal. To figure this accurately it is necessary to know the total number of hours each engine operates during the year since the Diesel requires the same amount of lubricating oil at part loads as at full load. When the figure 1200 kw. hr. per gal. is used, the assumption is made that the entire year's output is at rated capacity. For estimating purposes this may be increased 20%, so in this case the consumption would be 950 gal. which, at an average price of 55 c. per gal., would total $522.

The labor charge against the plant would be $5000 as previously stated. In the case of a plant operating on a single shift this would be cut proportionately.

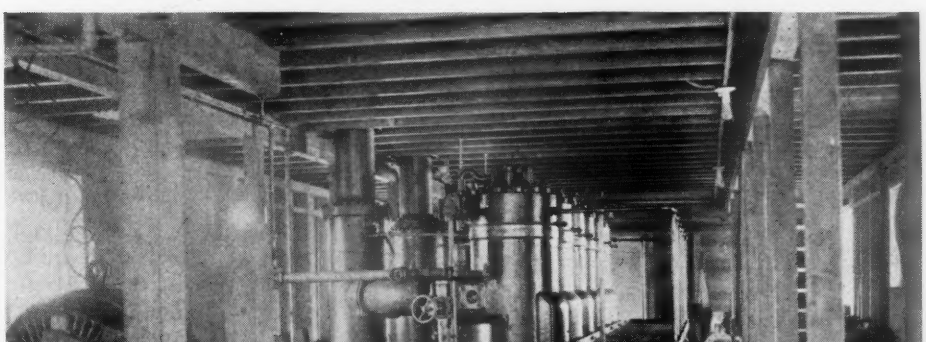
A plant of this size, assuming that the engines are installed in a part of one of the available buildings, would cost approximately $32,500. Of this total about 80% is made up of equipment which will require some maintenance as the years go by. In other words 2% of $25,000 should be set aside for building up a fund for this purpose. This would amount to $500 per year. The fixed charges would be 11.72% of $32,500 or $3800. This includes interest, taxes, insurance and a sinking fund which will retire the investment in 20 years.

The total cost of operation would therefore be as follows:

	Total cost	Cost per kw. hr.
Fuel oil	$ 4,750	$0.0050
Lubricating oil	522	.0005
Labor	5,000	.0052
Maintenance	500	.0006
Fixed charges	3,800	.0039
	$14,572	$0.0152

Of this total expense 1.07 c. per kw. hr. is the direct charge and the 0.45 c. covers maintenance and depreciation.

Such power costs as these can be obtained in plants requiring less than 100 hp. as well as in plants requiring several thousand horsepower. Where the load on the plant is reasonably constant so that the maximum number of power units is produced per unit of labor cost and fixed charges, the power cost may be even lower than these figures. It is not uncommon to find Diesel plants with a direct power cost of less than a cent per kilowatt hour and a total cost, with fixed charges and maintenance in-

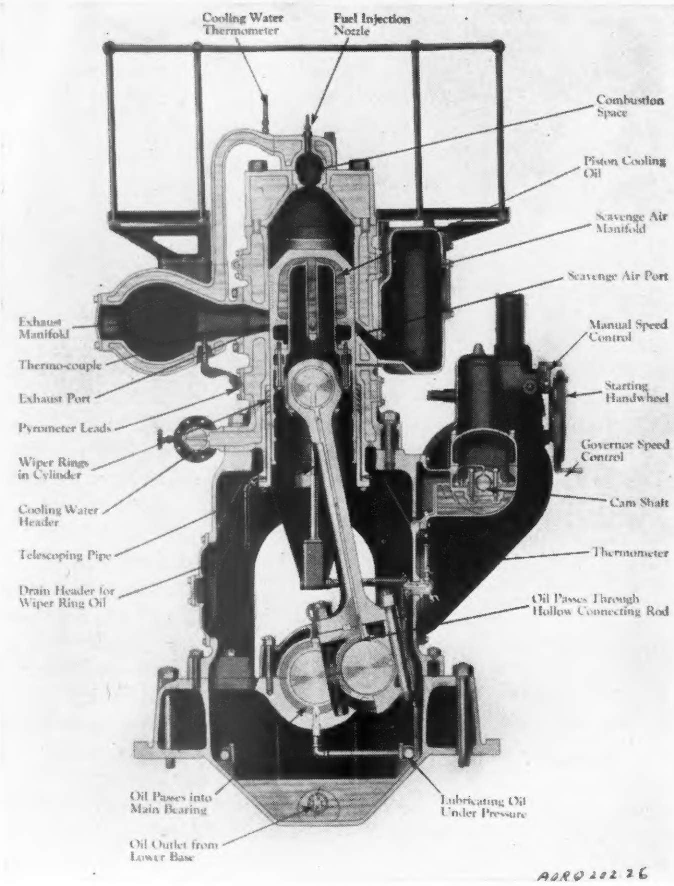


Suction dredge "Progress," owned by D. W. Ireland, Ft. Myers, Fla. This is driven by a 360-hp. Diesel engine direct connected to a centrifugal pump belted to a 55-kw. generator

cluded, around 1.25 c. per kw. hr.

The modern Diesel engine is a dependable machine which is comparatively simple to operate. The accompanying illustrations of a 720-hp. Diesel engine show the type of machines which are now going into a wide variety of industrial service. This particular machine which has been brought out in ratings of 480-, 600- and 720-hp. by Fairbanks, Morse and Co. is similar in general principles to the smaller line of engines built by this company which were described in the March 7, 1925, issue of ROCK PRODUCTS.

Like its predecessors, the new engine is a two-cycle, single-acting, port-scavenging, airless-injection Diesel. The studies showed that all of these principles of engine design were just as valuable in engines of this rating as for lower ratings. The main refinement which were possible in an engine of this size are the use of an outside air pump for supplying the scavenging aid, oil cooling for the pistons and pressure lubrication of all bearings, pins and gears. No cross head is used, for it was found that the cross head would increase the height and weight of the engine without any corresponding advantages.



Sectional view through the engine showing control mechanism, fuel injection and lubrication systems, etc.

One hand wheel as shown in the accompanying photographs, is used for starting and stopping the engine. When the wheel is thrown over to the start position the starting air comes on and then as the wheel is brought back to the run position the flow of oil to injection pumps begins.

Another hand wheel which is located on the governor may be used to change the speed through a considerable range. This is used when it is desired to parallel two or more Diesel electric units or where the drive requires a speed variation.

All of the control mechanism, including the air starting valves, fuel injection system and governor, are located in the compact unit shown at the hand wheel. The cam shaft and all of the cams which operate the injection pumps and gears which drive the governor operate in oil. The cam shaft itself is driven by a three-gear train and each gear is lubricated by a stream of oil at the point where it meshes with the adjoining gear of the train. Positive lubrication and quiet operation is thus assured.

The entire lubrication system of this engine is a marked advance in Diesel engine practice. There is not a single point on the engine which is not reached by pressure lubrication. There is no need for an oiler because there wouldn't be anything for him to do.

Improvements in the design of Diesel engines, together with improved manufacturing methods, have made it possible to install Diesel engines of this type which will give dependable service over a long period of years and which will rapidly pay for themselves by lowering power costs.

Engine Wear Depends on Lubrication

By G. S. HAMILTON
Of the Climax Engineering Co., Clinton, Iowa

ALL automobile users know that a properly lubricated car is quieter and more satisfactory in its operation. Care in this respect will be repaid many times over by the long life of the motor. The same holds true for the heavy-duty, industrial engine used on cranes, shovels, locomotives, etc.

Where two moving parts are perfectly lubricated there is no wear because they do not come in contact with each other—but are separated by a thin film of oil. This is a condition that we would like to find in all of our industrial engines. There are many things that make this degree of perfection hard to attain, but the correct oil, properly used, will provide very safe protection against wear. Proper use is essential, for no matter how good the oil may be when it is put in, careless operation may destroy its value.

If the engine is run intermittently—only for a short time daily—it is quite likely that the engine will never get hot enough to work at its best efficiency. This means that the gasoline will never completely vaporize, but that some of the liquid fuel will pass by the pistons and mix with the lubricating oil. Oil that has been too much thinned down by this dilution does not have the necessary strength to separate the moving parts of the engine and protect them against wear.

When working under dusty conditions, the air which is drawn into the engine through the carburetor carries with it quite a quantity of grit and abrasive material. If this is carried to excess, the oil is contaminated, and becomes to some extent a grinding compound instead of a lubricant.

If the correct oil is used in your engine and is changed often enough to keep out the abrasives, and if the engine is kept hot enough to guard against excessive dilution, at the end of two years service it will be a very much newer engine.

Play safe, change the oil in your engine every 50 working hours, and keep down excessive wear.

Production and Upkeep of Rock Drill Steel

AN interesting innovation in connection with the physical development of mines is the establishment of a central drill steel shop at Cardin, Okla., by the Commerce Mining and Royalty Co., which serves its mines scattered over a fairly large area. Before installing the new plant, the company commissioned the Gilman Manufacturing Co., East Boston, Mass., to develop and design the plant and to recommend the type of equipment. A survey was made and because of the fundamentals involved, it is sure to be of interest to all rock products manufacturers who use rock drills and drilling equipment.

The governing factors were: (a) The shape of drill bit to meet most advantageously the varying character of the ground in this district. (b) The proper variation in gage diameter of the drill bit for the different lengths of drill steel. (c) The most advantageous sizes and sections of hollow rock drill steel consistent with the conditions. (d) The most advantageous type of drill steel shank. (e) The permissible change length of drill steel.

As a result of this analysis, it was de-

cided to standardize upon two sizes of round section hollow drill steel, 1-in. and 1⅛-in. diam., both having the standard lugged shank for adapting the steel to the bayonet lock type of drill chuck employed by the light and heavy drifters with which the mines are equipped. For the heavy drifter rock drill, 1⅛-in. round hollow drill steel is used for drilling holes to a maximum of 20 ft., in 30-in. change lengths, and the lighter type of one-man drifter employs 1-in. round hollow steel for drilling to a maximum depth of 14 ft., in 24-in. change lengths.

A cross bit having a cutting edge angle of 90 deg. with a true reaming edge clearance angle of 7 deg., backed up by a 14-deg. wing angle, was determined to be best suited to the rock conditions in the field for both sizes of drill steel, and the gage decrement or the variation in gage diameter of the drill bit for the different change lengths of steel as 3/32 in. The mouth diameter of the holes drilled with the 1⅛-in. steel is 2⅛ in. and that of the 1-in. steel is 1 15/16 in., which with the 3732 gage variation provides for a bottoming size of sufficient size to accommodate the employment of blasting cartridges 1¼ in. in diameter at the required depth of both sizes of drill hole.

To maintain the standard shape of drill bit and shank throughout as great a penetration as possible, without undue wear or breakage, and incidentally to reduce to a minimum the number of pieces of drill steel required for the work, a standardized system of procedure has been established for forging both the bit and shank ends, and a standardized method has been adopted for its heat treatment, prior to the time at which the individual steels are inspected and placed in the finished drill steel storage racks.

Weston and Brooker Replacing Burned Plant

WORK on rebuilding of the Weston and Brooker quarry building damaged by fire a short time ago at Cayce, S. C., is now under way. The new plant will be constructed along the most modern lines. When completed this will be one of the most up-to-date crushed granite plants in the country it is stated.

The fire which damaged the plant, crushers and bins, ruined a good deal of the machinery, and this is being replaced by modern equipment. The new building will measure 42x54 ft., and will be 60 ft. high. The stone will be brought from the quarry and dumped into a primary breaker and passed over a grizzly and the oversize conveyed to other crushers, and again screened. There will be a conveyor belt leading to the bins and stone house, 180 ft. away, where aggregate will be mixed to any kind of specification.

The new building will contain eight different bins, of different sizes of stone. Beneath the building there will be a railroad on one side for loading on cars, and on the other a place to load on trucks. The bins will hold 1500 tons. The new machinery is being arranged differently from the old plant, and will enable the company to handle a considerably larger out-put. They are at present shipping rip-rap stone, but will be in position to ship crushed granite about the first of November.

The new building is to be built entirely out of steel. All of the new machinery is arranged to run on a 3-phase 60-cycle electric current.—*Columbia (S. C.) Record.*

E. W. Lazell to Superintend Kiln Construction at Enterprise Plant

E. W. LAZELL, chemical engineer for limestone and limestone products, will supervise the construction of the new kilns of the Black Marble and Lime Co., which is building a new plant at Enterprise, Ore. Mr. Lazell was the designer of the Martinsburg, W. Va., plant of the Security Cement and Lime Co., one of the outstanding lime plants in this country.

The foundation of one kiln at Enterprise is now being rushed because of demand expected from several west coast paper mills. One mill has already contracted for 10 carloads of lime a month. It is expected that by the time the plant is ready for the first kiln to operate there will be orders booked for at least 15 carloads a month. The Alder Slope district which the company will work at Enterprise is said to contain a high grade of limestone.

The expected shipment of machinery includes four complete steel-jacketed shells and fire brick for four kilns, as well as a hydration plant, stated W. C. Demorest, general manager of the company. This is a part of the plant of the International Lime Co. at Sumas, Wash., which is now being dismantled. The limestone deposits at this place were purchased by one of the large cement companies on the Pacific Coast.

New Gravel Company at Houston

INCORPORATON of a new firm for producing sand and gravel for the Houston, Tex., district was filed recently. The firm will be known as the Hilltop Gravel Co., with a capital stock of $30,000. The incorporators are: F. L. Overton, Emil Schmidt and R. E. Watters. The new company has purchased a tract of 40 acres near La Grange, Tex., from which the gravel will be obtained, washed and screened and shipped to Houston in carload lots. Production will first be limited on gravel for construction work with later efforts directed toward road gravel, according to plans of the officers. The daily output from the pits at La Grange will be between 8 and 10 cars per day. Draglines have been installed and loading equipment is in place ready to start. The gravel is said to be of a good grade.

H. D. Pratt on Road to Recovery

THE many friends of Howell D. Pratt, of Philadelphia, Penn., will be glad to know that he is on the road to recovery from a long and very severe illness. For

Howell D. Pratt

a number of years he was an engineer with the Link-Belt Co., and more recently a consulting engineer in the lime, quarry and sand and gravel industries. Last April he was taken seriously ill, and for many months his life was despaired of. We are glad to be able to state that he is now up again from his hospital bed, and more rapid progress toward complete recovery is hoped for and expected.

Dull Market Causes Oregon Portland to Close Quarry

THE present dull condition in the cement market in Oregon, due to inportation of foreign cement and low demand from road and building construction, has caused the Oregon Portland Cement Co., to close its quarry located near Dallas, a recent dispatch in the Dallas (Ore.) *Observer,* states: The quarry supplied from 25 to 30 cars per week of natural cement rock to the cement mill at Oswego. It is expected that the shut-down will be for only a few months or until conditions improve.

Only a short time ago, the Superior Portland Cement Co., Concrete, Wash., announced that it would cut its production until demand for cement in the locality caught up with the supply in storage.

Traffic and Transportation

EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning September 27:

CENTRAL FREIGHT ASSOCIATION DOCKET

14071. **Gravel and sand,** except blast, engine, foundry, glass, loam, marl, molding and silica, carloads, Anderson, Ind., to Middletown, Elwood and Kokomo, Ind. Present rates, sixth class to Middletown, 69c per net ton to Elwood and 76c per net ton to Kokomo, Ind.; proposed, 60c to Middletown and Elwood, Ind., and 70c per net ton to Kokomo, Ind. Not subject to Combination Tariff 228, I. C. C. U. S. No. 1.

14078. **Crushed stone,** carloads, North Baltimore, Ohio, to Ohio. (Per net ton, except as noted.)

To—	Present	Proposed
Sidney	80c	70c
Piqua	90	80
Troy	90	80
Dayton	90	80
Miamisburg	110	100
Middletown	17c cwt.	100
Hamilton	110	100
Cincinnati	120	100

14080. **Stone,** broken, crushed, rip rap, rough (not dimension), rubble and crushed granite, carloads, Kewaunee, Manitowoc and Milwaukee, Wis., also Menominee and Manistique, Mich., to Detroit, Flint and Ypsilanti, Mich., also Toledo, Ohio. Present rate, 136c per net ton; proposed, proportional rate of 150c per net ton.

14082. **Gravel and sand,** except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica, carloads, West Ellwood Jct., Penn., to Eidenau, Penn. Present rate, sixth class; proposed, 90c per net ton.

14093. **Gravel and sand,** lake, river and bank (other than sand loam), carloads, Michigan City, Ind., to Columbus, Ind. Present rate, 239c per net ton; proposed, 202c per net ton.

14105. **Crushed stone** and crushed stone screenings, carloads, Bluffton, Ind., to various points in Indiana. Route via N. Y. C. & St. L. R. R. (Lake Erie & Western district), Hartford City, Ind., and Pennsylvania R. R.

To—	*Proposed Rate
Bethevan	90c
Gas City	90
Upland	80
Renner	80
Mill Grove	80
Dunkirk	85
Red Key	85
Powers	85
Ridgeville	90

*Per net ton.

Present rates—Sixth class. Proposed rates not subject to rules for constructing combination rates as provided in I. C. C. U. S. 1.

14136. **Sand,** carloads, Ottawa, Ill., district to Peru, Delphi and Lafayette, Ind. Present rate, 239c per net ton. Present minimum weight, 90% of marked capacity of car except when car is loaded to full cubical or visible capacity actual weight will apply. Proposed rate—214c per net ton, in connection with the Wabash Ry.

14141. **Sand and gravel,** carloads, Mantua, O., to Cleveland, Mahoning, Phalanx and Warren, Girard and Youngstown, O. Present rates, 70c per ton of 2000 lb. to Cleveland, Mahoning, Phalanx and Warren, O., and 80c per ton of 2000 lb. to Girard and Youngstown, O. Proposed, 60c to Cleveland, Mahoning, Phalanx and Warren, O., and 70c per ton of 2000 lb. to Girard and Youngstown, O.

TRUNK LINE ASSOCIATION DOCKET

13921. **Silica sand,** carloads, from Glen Morris, Md., to Gatineau, Que., $6.35 per 2000 lb.

Reason—Proposed rate is fairly comparable with others on like commodities from and to points in the same general territory. File 42573.

13922. **Limestone,** unburnt, ground or pulverized, carloads, minimum weight 50,000 lb., from Martinsburg, W. Va., group stations to all points on the Washington, Brandywine and Point Lookout railroad, 14c per 100 lb.

Reason—Proposed rate is based 4c per 100 lb. over existing rate of 10c per 100 lb. to Brandywine, Md., for P. R. R. delivery, as per B. & O. Tariff I. C. C. 10734. File 42601.

13949. (A) **Building lime,** carloads, minimum weight 30,000 lb., (B) agricultural, land, chemical, gas or glass lime, carloads, minimum weight 30,000 lb., also ground limestone, carloads, minimum weight 50,000 lb., from Bellefonte and Pleasant Gap, Penn., to Atlantic City and Wildwood, N. J., (A) 17½c, (B) 16c per 100 lb. (subject to Rule 77).

Reason—To establish rates comparable with those in force from Bellefonte, Penn., to other points in South Jersey. File 42489.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

10936. **Dust, marble,** from Fall Village, Conn., to Gypsum, Ohio, 24c. Reason: To meet rate in effect from Tuckahoe, N. Y.

SOUTHERN FREIGHT ASSOCIATION DOCKET

29179. **Marble,** crushed and marble dust, from Gantts Quarry, Emauhoee and Brownson, Ala., to Northfield, Ohio. In lieu of combination rates, it is proposed to establish the following commodity rates from and to points mentioned: Marble, crushed, carloads, minimum weight 90% of marked capacity of car, except that when cars are loaded to their visible capacity, actual weight shall govern (does not include switching charges from L. & N. R. R. to any connecting line; such switching charges will be in addition to rate), 488c per net ton; marble dust, carloads, minimum weight 90% of marked capacity of car, except that when cars are loaded to their visible capacity, actual weight shall govern, 567c per net ton. Proposed rates are in line with rates to other points in the same general territory.

29180. **Molding sand,** from Cincinnati, Ohio, to Nashville, Tenn. In lieu of 248c per net ton rate, it is proposed to establish rate of 203c per net ton on sand, molding, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight shall govern, from Cincinnati, Ohio, to Nashville, Tenn., same as present rate from Newport, Ky.

29198. **Stone,** broken or crushed, from Frankfort, Blankenbakers and Louisville, Ky., to L. & N. R. R. stations, Cincinnati division and Lexington branch. It is proposed to establish the following reduced rates on stone, broken or crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight shall govern, such rates being made with relation to rates published by Southern Ry. from Tyrone, Ky., to stations on the So. Ry. for similar distances:

To—L. & N. R. R., Cincinnati Div.	Blankenbakers,	Frankfort, Louisville
O'Bannon, Ky.	....	72
Powee Valley, Ky.	....	72
Crestwood, Ky.	....	72
Glenarm, Ky.	....	72
Buckner, Ky.	....	72
Lexington Branch:		
LaGrange, Ky.	77	72
Jericho, Ky.	72	77
Smithfield, Ky.	68	77
Eminence, Ky.	68	81
Hill Spring, Ky.	68	86
Pleasureville, Ky.	68	86
Cropper, Ky.	68	86
Christiansburg, Ky.	68	86

29199. **Stone,** broken or crushed, carloads, from Frankfort, Viley, Mt. Vernon, Spark's Quarry, Pine Hill, Mullins and Yellow Rock, Ky., to Ewing, Ky., and intermediate stations. It is proposed to establish the following reduced rates on stone, broken or crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, to Ewing, Ky.: From Frankfort and Viley, Ky., 99c per net ton; from Mt. Vernon, Spark's Quarry, Pine Hill and Mullins, Ky., 113c per net ton and from Yellow Rock, Ky., 108c per net ton, such rates to be observed as maximum at intermediate points of destination. The proposed rates are made in line with rates from and to other points in the same general territory, distance considered.

89207. **Sand and gravel,** from Cincinnati, Ohio, to O. & K. Ry. and Caney Valley Ry. stations. In lieu of combination rates, it is proposed to establish rates on sand and gravel, carloads, from Cincinnati, Ohio, to stations mentioned above, same as recently approved in connection with Submittal 28735, from Louisville, Ky.

29212. **Sand and gravel,** from Cincinnati, Ohio, Ludlow, Ky., Harriman, Tenn., and Chattanooga, Tenn., to Roches Creek, Tenn. In lieu of class basis, it is proposed to establish the following commodity rates on sand and gravel, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, to Roaches Creek, Tenn.: From Cincinnati, Ohio, and Ludlow, Ky., 212c; Harriman, Tenn., 149c; Chattanooga, Tenn., 185c per net ton—made by use of single line scale published in So. Ry. I. C. C. A-9895, for the actual distance to and from Oneida, Tenn.

29213. **Sand and gravel,** from Bainbridge, Ga., to Ga., Fla. & Ala. Ry. stations. It is proposed to establish reduced rates on sand and gravel, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to visible capacity, actual weight will apply, from Bainbridge, Ga., to stations on the G. F. & A. Ry., made basis of the proposed Georgia scale, less 10%, for Class D lines. The proposed rates range from 70c for 20 miles up to 103c for 50 miles and 124c per net ton for 90 miles.

29246. **Stone, broken or crushed,** from Russellville, Ky., to Franklin, Salmon, Woodburn and Rich Pond, Ky. In lieu of rate of 90c, it is proposed to establish 81c rate per net ton on stone, broken or crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from and to points mentioned.

29257. **Crushed stone,** Roanoke, Va., to Hill Top, N. C. Present rate, 205c per net ton (Jamestown, N. C., combination). Proposed rate on stone, crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight shall govern, from Roanoke, Va., to Hill Top, N. C., 160c per net ton, same as in effect to Jamestown, N. C.

29270. **Stone, crushed,** from Ladds, Ga., to Marianna, Fla. In lieu of combination, it is proposed to establish through rate of 270c per net ton on stone, crushed, carloads, minimum weight marked capacity of car, from Ladds, Ga., to Marianna, Fla., same as rate in effect to River Junction, Fla.

29271. **Sand,** from Dixiana, S. C., to Almond, N. C. Lowest combination now applies. Proposed rate on sand, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, from Dixiana, S. C., to Almond, N. C., made on basis of the proposed Georgia scale for joint application by the Trunk Lines, less 10%.

29294. **Limestone or marble, ground or pulverized,** from Sparta, Tenn., to Riceboro and Townsend, Ga. No through rates in effect. Proposed rates on ground or pulverized limestone or marble, carloads, minimum weight marked capacity of car, except when car is loaded to full visible capacity, actual weight will apply, from Sparta, Tenn., to Riceboro, Ga., 279c; to Townsend, Ga., 288c per net ton; based on carriers' proposed Georgia scale, less 10%.

29296. **Crushed stone and agricultural stone,** from Louisville, Ky. (when from beyond), to L. & N. R. R. stations. It is proposed to establish the following proportional rates on: Stone, crushed, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern; agricultural stone (ground limestone), carloads, minimum weight 60,000 lb.; from Louisville, Ky. (when from beyond), to points on the L. & N. R. R., from Louisville to Lebanon Jct., inc., Louisville to LaGrange, inc., and Louisville to Shelbyville, Ky., inclusive, viz.: To L. & N. R. R. Main Stem: Highland Park and South Park, Ky., 55c; Coral Ridge to Salt River, inc., 65c; to Bardstown Jct. to Lebanon Jct., inc., 75c per net ton. To Cincinnati Division: St. Matthews and Lyndon, Ky., 55c; Lakeland to Glenarm, Ky., inc., 65c; Buckner and LaGrange, Ky., 75c per net ton. To Shelby Branch: Chenoweth to Long Run, Ky., inc., 65c; Lincoln Ridge to Shelbyville, Ky., inc., 75c per net ton. The proposed proportional rates will make the total charge on traffic from Milltown, Ind., to the destinations named approximately the same as formerly existing under the use of the Jones Combination Tariff.

29300. **Sand,** from Mack, Ga., to Florida points. It is proposed to establish the following reduced rates on sand, carloads, minimum weight 90% of marked capacity of car, except where cars are

loaded to visible capacity, actual weight will govern, from Mack, Ga.: To Jacksonville, Fla., 144c; Jasper, Fla., 122c; Lake City, Fla., 135c; Live Oak, Fla., 131c; Perry, Fla., 135c; Champaign, Fla., Fraleighsmith, Fla., and Greenville, Fla., 122c; Aucilla, Fla., 126c; McClellan and Drifton, Fla., 131c per net ton; made on basis of the proposed Georgia scale, less 10%, for application over Class "A" lines.

29332. **Whitestone,** powdered, and ground limestone, from Whitestone, Ga., to Montgomery, Ala. Present rate, 260c; proposed rates on whitestone, powdered, and ground limestone, carloads, minimum weight 60,000 lb., from Whitestone, Ga., to Montgomery, Ala., 214c per net ton, same as rate in effect from and to other southern points of similar distances.

29333. **Crushed stone** from Mullins, Ky., to L. & N. R. R., Knoxville Division stations. It is proposed to reduce the rates on crushed stone, carload minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity actual weight will govern, from Mullins, Ky., to stations on the Knoxville Division of the L. & N. R. R. to be the same as in effect from Spark's Quarry, Ky.

29376. **Crushed or broken stone,** from Yellow Rock, Ky., to stations on the L. & N. R. R., Eastern Kentucky Division. It is proposed to establish the following reduced rates on stone, crushed or broken, carloads, minimum weight 90% of marked capacity of car, except when cars are loaded to their visible capacity, actual weight shall govern, from Yellow Rock, Ky., to Hazard, Lothair, Christopher, Diablock and Glomawr, Ky., 99c per net ton; to Jeff, Stormking and Viper, Ky., 104c per net ton, such rates to be observed as maxima at intermediate destinations. The proposed rates are for the purpose of permitting shippers at Yellow Rock to meet competition of small highway quarries located along the route where an improved highway is being constructed.

29378. **Sand and gravel,** from Jackson's Lake, Prattville Junction, Oktamulke and Coosada, Ala., to Wetumpka, Ala. It is proposed to establish the following reduced rates on sand and gravel, carloads, minimum weight 90% of the marked capacity of car, except when cars are loaded to their visible capacity, actual weight will govern, to Wetumpka, Ala.: From Jackson's Lake and Prattville Junction, 54c; from Oktamulke and Coosada, 50c per net ton, made in line with rate recently established from Montgomery to Wetumpka.

29396. **Sand and gravel,** from W. Ry. of Ala. local pits to Ga., Fla. & Ala. Ry. stations. In lieu of combination rates over Montgomery, Ala., it is proposed to establish through rate of 176c per net ton on sand and gravel, straight or mixed carloads, as described in Commodity Group 3, page 4, W. Ry. of Ala. I. C. C. A64, from W. Ry. of Ala. local pits, such as Arrowhead, Chehaw, Milstead and Rice, Ala., to G. F. & A. Ry. stations between Bainbridge, Ga., and Tallahassee, Fla. Same as rate in effect from Montgomery, Ala.

WESTERN TRUNK LINE DOCKET

3545-O. **Sand,** carloads, from sand loading tracks of the K. C. S. Ry. Co., in Elmdale Yard, Kansas City, Mo., serving the Peck Thompson Sand Co., to all industrial and team tracks as shown in W. T. L. Tariff 156-N, page 3. Present—Switching charges to connecting line as shown in P. A. R. 4-T, I. C. C. 4462. Proposed—To add to list of origins as shown in first group of origins on page 3 of W. T. L. 156-N immediately following Item 20, sand loading tracks, K. C. S. Ry Co., serving the Peck Thompson Sand Co., minimum weight 40,000 lb.

2079-C. **Stone, crushed** (stone dust), carloads, from Mayville and Waukesha, Wis., and Bellewood and Joliet, Ill., to Centerville, Iowa. Present, Class E or 20½c per 100 lb., from Chicago Group to Centerville; proposed, 13½c per 100 lb., from Group A (Chicago) to Group 17 (Des Moines, Centerville, etc.) Minimum weight 90% of marked capacity of car, except when weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity, actual weight will apply, but not less than 40,000 lb.

2079-D. **Stone, crushed** (granite), carloads, from Berlin, Red Granite and Montello, Wis., to Centerville, Iowa. Present, Ft. Madison, Iowa, combination is $3.39 per net ton, routing via Soo Line, Chicago, A. T. & S. F., Ft. Madison and C. B. & Q. Through Class E rate of $4.10 per net ton carries routing via Soo Line, Chicago and C. B. & Q. Proposed, 13½c per 100 lb., the same as now in effect to Des Moines per Item 6880, W. T. L. Tariff 50-M. Minimum weight 90% of marked capacity of car, except when weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity, actual weight will apply, but not less than 40,000 lb.

4901-A. **Slag or stone, crushed,** carloads: From Wells, Mich., to Chicago, Ill., C. & N. W., 13½c, present crushed stone rate; proposed, 12c.

From Wells, Mich., to Chicago, Ill., C. M. & St. P., 10c, present, Item 3160, G. F. D. 2400-L; proposed, 12c.

From Wells, Mich., to Chicago, Ill., Soo, 13½c, present, I. C. C. 6087; proposed, 12c.

Iron Mountain, Mich., to Chicago, Ill., C. & N. W., 13½c, present, Item 823-A, G. F. D. 8115-K; proposed, 12c.

Iron Mountain, Mich., to Chicago, Ill., C. M. & St. P., 10c, present, Item 3160, G. F. D. 2400-L; proposed, 12c.

Iron Mountain, Mich., to Chicago, Ill., Soo, 13½c, present, I. C. C. 6087; proposed, 12c.

Randville, Mich., to Chicago, Ill., C. M. & St. P., 12c, present, Item 6570, G. F. D. 2400-L; proposed, 12c.

Felch, Mich., to Chicago, Ill., C. & N. W., 12c, present, Item 823-A, G. F. D. 8115-K; proposed, 12c.

Escanaba, Mich., to Chicago, Ill., C. & N. W., 13½c, present, Item 823-A, G. F. D. 8115-K; proposed, 12c; C. M. & St. P., 10c, present, Item 3160, G. F. D. 2400-L; proposed, 12c.

Minimum weight 90% of marked capacity of car, except that when weight of shipments loaded to full visible capacity of car is less than 90% of marked capacity of car, the actual weight will apply, but in no case shall the minimum weight be less than 40,000 lb.

4559-B. **Sand, gravel or stone,** crushed, chipped, dust, riprap and rubble, carloads, from Sugar Creek, Mo., to stations on the Union Pacific and St. J. & G. I. Ry. in Nebraska. Present, Class "E" rates. Proposed—Application of Nebraska single line distance scale plus 1%. Minimum weight 90% of marked capacity of car, except when weight of shipments loaded to full visible capacity of car is less than 90% of marked capacity of car the actual weight will apply, but in no case shall the minimum weight be less than 40,000 lb.

5110-A. **Stone, crushed,** carloads, from McDowell, Mo., to points in Kansas located within 150 miles of Kansas City. See the following representative points:

Station (Representative) Kansas	Road on which Located	Miles	Rate Pres.	Rate Prop.
Action	Mo. Pac.	134	*	8
Bonner Springs	A. T. & S. F.	37.4	*	4½
Chiles	Mo. Pac.	62	*	5½
Deavers	A. T. & S. F.	97	*	7
Emporia	A. T. & S. F.	131.1	*	8
Franklin	Mo. Pac.	163	*	9
Glen Park	St. L.-S. F.	22.1	*	4½
Henson	St. L.-S. F.	67.3	*	5½
Imes	Mo. Pac.	91.7	*	7
Morris	A. T. & S. F.	30	*	4½
Paola	Mo. Pac.	73	*	6
Paola	St. L.-S. F.	61.9	*	5½
Topeka	A. T. & S. F.	86	*	6½
Topeka	Mo. Pac.	154	*	8½
Zarah	A. T. & S. F.	36	*	4½

Minimum weight, 90% of marked capacity of car, except when cars are loaded to full capacity, actual weight but not less than 40,000 lb. (By shipper.)

*Combination.

SOUTHWESTERN FREIGHT BUREAU DOCKET

9693. **Limestone,** from Mosher and Ste. Genevieve, Mo., to Missouri river points. To establish the following rates on ground limestone, carloads, minimum weight 90% of marked capacity of car, but not less than 60,000 lb., from Mosher and Ste. Genevieve, Mo. To Atchison, Kan., Kansas City, Mo.-Kan., Leavenworth, Kan., and St. Joseph, Mo., 14½c per 100 lb. To Omaha, Neb., and Council Bluffs, Iowa, 16½c per 100 lb. It is pointed out that rates on limestone from St. Louis to Missouri river points are higher than the present rates on lime, and it is felt that rates on limestone from Ste. Genevieve and Mosher should be placed on an equitable basis over the St. Louis lime rate.

ILLINOIS FREIGHT ASSOCIATION DOCKET

3630-B. **Sand, gravel and crushed stone,** carloads (in cents per net ton), from:

To (representative points)—	Stolle Krause Pres.	Stolle Krause Pro.	Anna Pres.	Anna Pro.
Murphysboro, Ill.	70	65	70	65
Wolf Lake, Ill.	98	90	85	77
Christopher, Ill.	98	90	88	80
Coulterville, Ill.	70	65	65	65

To (representative points)—	Shelterville Pres.	Shelterville Pro.	Cairo Pres.	Cairo Pro.
Murphysboro, Ill.	94	89	65	90
Wolf Lake, Ill.	113	105	84	76
Christopher, Ill.	95	92	95	92
Coulterville, Ill.	126	108	113	108

To (representative points)—	Metropolis, Brookport, Golconda Present.	Proposed
Murphysboro, Ill.	94	89
Wolf Lake, Ill.	113	105
Christopher, Ill.	95	92
Coulterville, Ill.	113	108

I. R. C. 3869. **Crushed stone,** carloads, minimum weight marked capacity of car, from Dubuque, Ia., to Chicago, Ill. Rates per net ton—Present, $1.60; proposed, $1.30.

Crushed Stone Reparation

EXAMINER J. J. WILLIAMS in a proposed report in No. 17892, North American Cement Corp. vs. Western Maryland et al., embracing also two sub numbers, Same vs. Baltimore and Ohio, has recommended an award of reparation and a finding that present rates on crushed stone from Security, Md., to Best Gate, Md., and from Martinsburg, W. Va., to other destinations in Maryland are not unreasonable or otherwise unlawful. The shipments involved moved between January 1, 1922, and November 24, 1925.

Shipments from Security to Best Gate moved interstate over both the Western Maryland and the Baltimore and Ohio. Those from Martinsburg moved interstate over the B. and O. Charges on the shipments moving over the Western Maryland were assessed on the basis of the through sixth-class rate of $4.30. The examiner said the commission should find that the rate was applicable but that it was unreasonable to the extent that it exceeded $1.40. The shipments moving over the B. and O. were assessed $1.40. The examiner said the commission should find that a rate of $1.10 was applicable.

Gravel Rates Unreasonable

EXAMINER A. S. WORTHINGTON, in a proposed report in No. 17871, W. M. Spencer Co. vs. Santa Fe et al., has recommended that the commission find that a rate of 13.5 c., collected on six carloads of gravel from Holliday, an., to St. Joseph, Mo., in May, 1925, was, is and for the future will be unreasonable to the extent that it exceeded, exceeds or may exceed 5 c. a hundred pounds, and awarded reparation.

Lower Sand and Gravel Rates

EXAMINER MORRIS H. KONIGSBERG has proposed an award of reparation and prescription of rates for the future in No. 17606, Cynthiana Construction Co. vs. Louisville and Nashville et al., on a finding that rates on sand and gravel from Cincinnati, Ohio, to Independence and Butler, Ky., were, are, and for the future will be unreasonable to the extent that they exceeded, exceed, or may exceed, a rate of 54 c. per ton from Cincinnati to Independence and 68 c. per ton from Cincinnati to Butler.

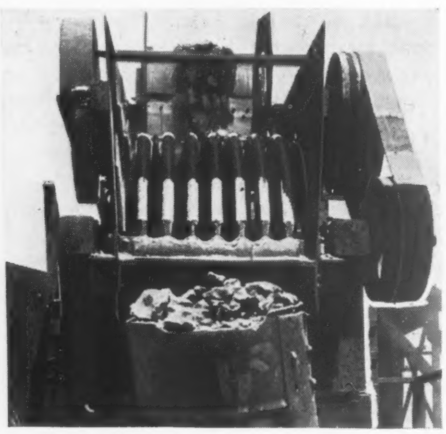
Crushed Rock Reparation

A FINDING of unreasonableness and an award of reparation have been made in No. 17251, Board of Park Commissioners vs. Chicago, Milwaukee and St. Paul et al., mimeographed, as to a rate on crushed rock from Dresser Junction, Wis., to Minnehaha, Minn., applied on shipments in 1923 and 1924. The commission, by division 4, found that a rate of 5 c. and a switching charge of $1.80 per car were unreasonable to the extent they exceeded 3.5 c. per 100 lb. and awarded reparation to that basis.

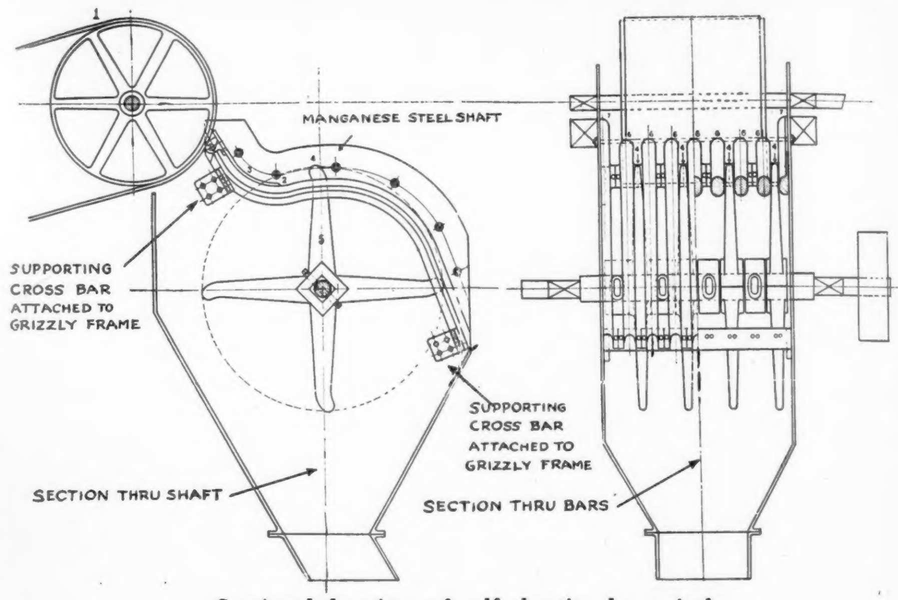
New Machinery and Equipment

New Self-Cleaning Bar Grizzly

THE Webster Mfg. Co., Chicago, Ill., announces the "Nelson" self-cleaning bar grizzly, which is said to be particularly adapted for scalping wet, talcy material. The machine, it is said, operates on a minimum of power, requires little supervision and gives a clean product at maximum capacity regardless of material wet or dry.



Bar grizzly for wet materials



Sectional drawings of self-cleaning bar grizzly

The operation of the grizzly with reference to the sketch is as follows:

From the belt carrier (1) the run of material drops onto the convex part of the grizzly (2) over the hinged apron (3) which is kicked at its end by the finger ends (4) of the revolving arms (5). This spreads the rock over the whole width of the grizzly, avoiding undue wear in the middle. The finger ends (4) of the 32 alternating arms (5) come up four at a time, dislodging any of the "balled up" wet fines that may tend to stick in the bars of the grizzly. The manganese steel bars themselves (6) are rounded above and tapered to a point below to allow free space for the material to drop easily. At each side of the grizzly, rising considerably above the top surface of the bars (6), are protective members (7) of manganese steel to save the iron sides of the grizzly from undue wear.

Grizzlies of this type can be furnished in diameters of 36 in., 48 in. or 60 in. in any width up to 10 ft., and with manufacturer's rated capacity up to 500 tons of material per hour and make any desired separation between 1 in. and 6 in.

New Mixed Mortar Plant

A NEW mixed mortar plant is being placed on the market by H. Miscampbell of Duluth. This plant is said to contain certain features which are of interest to lime plant operators. The complete plant, the machinery or the engineering service may be purchased.

New Mill Type Compensator

A COMPENSATOR which will cover ratings above 30-h.p. on 220-volt circuits and 60-h.p. and up on 440 and 550-volt circuits, has been introduced by the General Electric Co., Schenectady, N. Y., in a new design designated as size No. 2. Two-part construction is employed in order to meet a wide variety of installations.

One unit of the compensator consists of an oil-immersed, double-throw switch with temperature overload relay, push button station and undervoltage release. The other unit consists of an auto-transformer. Each unit is provided with a conduit box.

Assembled view of mill type compensator control switch

The control box is so arranged that the oil box may be lowered to allow examination of the switch parts and renewal of fingers and wedges. This unit can be wall mounted or attached to a pipe support.

Compensator with top and front covers removed, exposing relay, release, stop button and main switch

The auto transformer is inclosed in a cast iron box with a removable cover to allow changing tap connections when desired. The conduit box mounted on the top of this case provides ample room for making connections. The front of the con-

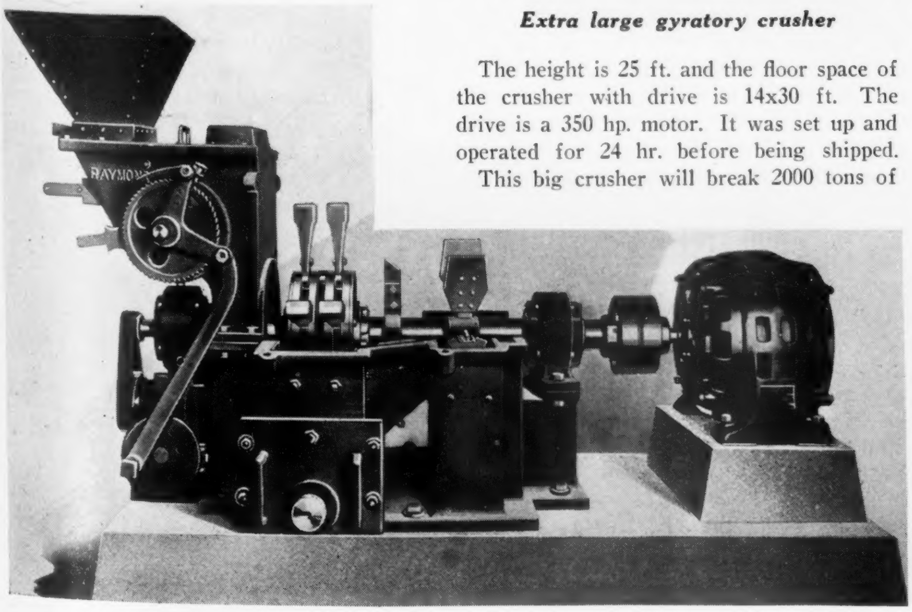
duit box is removable, the entire interior thus being accessible in order that joints may be tightened and properly taped.

Unit System of Pulverizing Fuel

THE C-E unit system, manufactured by the Combustion Engineering Corp., New York, N. Y., combines a pulverizing mill of the impact type with a furnace properly designed for the burning of pulverized fuel. It is applicable to boiler units of all sizes from 150 hp. up. In connection with existing boilers, the furnaces can be redesigned to meet the fuel burning requirements. If the setting is fairly modern, little redesigning may be necessary.

The mills are built in different sizes to provide an ample range of capacities and are classified according to number. Mills No. 20, 30, 40 and 50 are similar in design differing only in over-all proportions and the number and arrangement of hammers. Mills No. 60, 70, 80, etc., are similar to each other but differ in design from the smaller units in several important respects. The materials used and the details of construction are the same for all mills except where otherwise specified.

As may be seen from the illustration the coal enters through a hopper, mounted above an automatic feeding device, which discharges the fuel into the grinding chamber at whatever rate the boiler load requires. The grinding is done by a relatively high-speed rotor to which swing hammers are attached. The hammers break the coal down to a powder by the force of their impact and by knocking it against the walls of the grinding chamber. Mounted on the same shaft with the hammers are a fineness regulator and an exhaust fan. The fan continuously removes from the grinding chamber such particles of fuel as will pass the fineness regulator and discharges them into the delivery pipe of the burner.

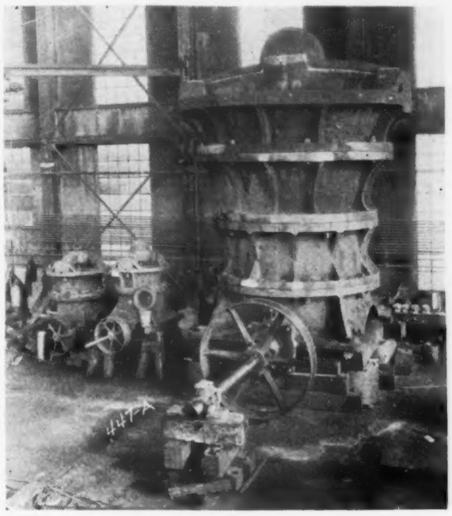


Unit system for pulverizing fuel

The mill is designed to use coal from 1 to 1½ in. ring size which it reduces to a desired degree of uniform fineness. Capacity is dependent on size and ranges from 500 to 20,000 lb. per hr., manufacturer's rating. Different mill sizes all are designed to operate at standard electric motor speeds and are supplied with flexible couplings for direct connection. They can also be driven by a steam turbine. Motor requirements for driving the mills, according to the manufacturers, is from 15 hp. for the smallest to 100 hp. for the largest. The mill is shipped completely assembled and ready to bolt to a foundation. The crushed coal can be fed to it from an overhead bin or by hand.

A Big Gyratory Crusher

ONE of the largest gyratory crushers ever built was recently shipped by the Traylor Engineering and Manufacturing Co. to a Michigan iron mine. It weighed 525,000 lb. and 10 freight cars were needed to carry it. The head and shaft weigh 46 tons, the eccentric 5 tons and the eccentric bushing two tons. The shaft alone weighs almost 25 tons.

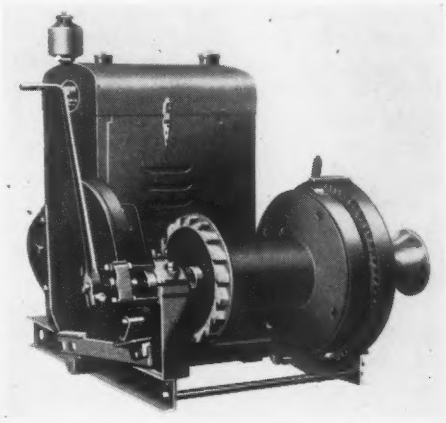


Extra large gyratory crusher

The height is 25 ft. and the floor space of the crusher with drive is 14x30 ft. The drive is a 350 hp. motor. It was set up and operated for 24 hr. before being shipped. This big crusher will break 2000 tons of ordinary rock per hour with the opening set to 9-in. ring size. It will break 1200 tons per hour set to 6-in. size. As the iron ore with which it is to be fed is considerably heavier than ordinary rock, the tonnage obtained will be even greater than the figures mentioned.

New Light-Duty Hoist

THE Novo Engine Co., Lansing, Mich., announce Model N H a new light-duty gasoline or electric driven hoist in which it is said several of the features usually found only in heavy duty hoists are incorporated. A special feature is the welded



Single-drum hoist, gas or electric powered

tubular frame, the first utilization, it is said of such design in a hoist.

The hoist is a single free drum type. Double cone, hard maple frictions, operated by high carbon thrust screw, are used. The drum is 8 in. in diam., 14 in. long and is bronze bushed and has ratchet cast on end at operator's side of hoist. A larger drum, 12 in. in diam., 14 in. long, is furnished when so ordered at extra cost. Cable capacities rated by the manufacturers are: 8-in. drum—1,250 ft. of ⅜ in. or 700 ft. of ½ in. ca.; 12-in. drum—700 ft. of ⅜ in. or 400 ft. of ½ in. cable. Intermediate and drum shaft bearings are babbitt and are adjustable. Lubrication by "Dot" high pressure grease gun.

The single drum hoists are powered with Novo 3, 4 or 6 hp. single cylinder engines—UF, 3-6 hp. and RF, 6-9 hp. hopper or radiator cooled two-cylinder engines. Also equipped with 3, 5 or 7½ hp. electric motor. Rated capacities are: 600 to 1600 lbs., depending upon power used, at from 110 to 135 ft. per min. Net weight of hoist, without engine or motor 740 lbs.

An Unusually Fine Bulletin

A BULLETIN published by the Shepard Electric Crane and Hoist Co. is one of the handsomest that has been issued by any machine manufacturer. It is devoted wholly to the lubrication of Shepherd cranes and hoists and is beautifully illustrated with "phantom" drawings showing the parts in perspective instead of the line drawings.

Ohio Gravel Producers Prepare for National Convention

THE Ohio Sand and Gravel Producers Association met at the New Neil House in Columbus, Ohio, September 15. The purpose of the meeting was to consider preparations for the association's part in the convention of the National Sand and Gravel Association which is to be held in January, 1927. At a previous meeting all the financial arrangements had been made so this meeting concerned itself only with the discussion of arrangements for entertaining guests and making certain that all who attended would enjoy the convention as well as profit by it. A few producers from other states who have been asked to join with the Ohio association in this work sent representatives.

Luncheon was served at 12:30 o'clock and the meeting was called to order by Earl Zimmerman, president of the association, when the coffee and cigars had been served.

V. P. Ahearn, executive secretary, and Stanton Walker, head of the bureau of engineering of the National Sand and Gravel Association, were present and were asked a number of questions about what was wanted of the local committees and how these should be formed.

Mr. Ahearn gave a rough outline of what had been prepared in the way of a program and asked for suggestions for completing the program. One of the most practical suggestions was that Mr. Walker should explain and demonstrate some of the methods of testing sand and gravel to find out whether or not it would pass certain specifications such as those of the A. S. T. M. and the American Concrete Institute. A number of those present expressed a wish to have Prof. Abrams address the convention, and it was decided to invite him to do so.

The meeting was quite informal and President Zimmmerman called on each person present in turn in order that everyone might have a chance to offer something.

Fred Hall, who is chairman of the convention committee, gave an excellent talk on the purposes of the convention and the prospects for a good one.

It was decided to send a special invitation to highway officials to be present at the convention. It was also decided to ask producers to see that their operating men attended so far as possible.

Those who were present, given in order as they sat about the table, are:

J. N. Dugan, J. N. Dugan Gravel Co.
F. E. Hall, T. J. Hall Co.
Fred Cornuelle, Red Bank Gravel Co.
Earl Zimmerman, Ohio Gravel Ballast Co.
Guy C. Baker, Greenville Gravel Co.
T. A. Brown, Arrow Sand and Gravel Co.
J. T. Adams, Concrete Materials Co.
Stephen Stepanian, Arrow Sand and Gravel Co.
Stanton Walker, National Sand and Gravel Association.
J. L. Masters, Arrow Sand and Gravel Co.
A. E. Frosch, East Liverpool Sand Co.
H. P. Caldwell, Ohio River Sand Co.
V. P. Ahearn, National Sand and Gravel Association.
Geo. C. Ross, Ohio River Gravel Co.
L. R. Warner, Marion Sand and Gravel Co.

Earl Zimmerman, president of the Ohio Sand and Gravel Producers' Association

E. W. Dienhart, Acme Concrete Products and Gravel Co.
Clifton Hoolihan, Keystone Gravel Co.
D. B. Swisher, Zanesville Washed Gravel Co.
Chas. M. Ault, Barnes Sand and Gravel Co.
R. A. Goodwin, *Cement, Mill and Quarry.*
Edmund Shaw, Rock Products.

Ball-Benton Company to Open New Pit

A RECENT announcement in the Newark, Ark., *Journal,* states that the Ball-Benton Gravel Co. has leased a gravel deposit in the west end of Newark, Ark., and will open a new plant as soon as a spur track can be built out to the deposit from the Missouri Pacific railroad. A switch for the spur track was put in recently and a large crew of men are now at work clearing and grading the right of way for the track to the deposit. A steam shovel and other modern equipment will be installed at the pit.

The Ball-Benton Co. operates a number of gravel plants in various parts of the state, the largest of which is located at Benton, Ark. A description of this plant was published in Rock Products, May 1 issue.

Ontario Supply and Transport Co.'s New Plant in Operation

THE first shipment of gravel from the recently completed plant at Sarnia, Ont., of the Ontario Supply and Transport Co. was recently made after a formal opening attended by dignitaries of the local Chamber of Commerce and company officials. The steamer Fontana, in charge of Capt. Samons, which was loaded with 4,000 tons of gravel from the plant, is the first vessel since 1870 to carry a cargo from the shore of Lake Huron at Sarnia.

The new plant, under construction for the past year, has a capacity of about 400 tons of washed and screened gravel per hour. The gravel is taken from the lake and after washing goes on conveyor belts leading to the loading docks. The plant was designed and built by the Stephens-Adamson Manufacturing Co., Aurora, Ill.—*Port Huron (Mich.) Times.*

Drew Gravel Company Expands

THE Drew Gravel Co., Inc., who recently purchased the tract of land from R. W. Stell about one mile east of Delight, Ark., is installing a new and larger gravel washing plant, which will be in operation in a short while.

Mr. Drew says that the plant that is now being installed will produce about 18 cars of washed gravel daily. The gravel at the new location, it is said, is of better quality than that at the old location and sufficient for about five years' run without another move.—*Delight (Ark.) Tribune.*

"Magic City" Not Seriously Damaged in Miami Hurricane

WE are informed by J. G. Wilson, engineer, Meteor Transport and Trading Co., Miami, Fla., that the dredge "Magic City," referred to in previous issues of Rock Products, while suffering some damage in the recent hurricane, was not seriously injured and none of its crew was lost.

This dredge, as has been noted before in these columns, is unique in the rock products industry. It is really a floating crushed-stone plant, using rock excavated in the government channel dredging operations in Biscayne Bay. The equipment includes a large size McLanahan roll crusher as a primary breaker, and two double-roll secondary crushers. Power is supplied by a 500-hp. Diesel engine.

The dredge was completed this summer at Wilmington, Del., the Meteor Transport and Trading Co. being closely allied to the Charles Warner Co. of Wilmington. It arrived at Miami on August 21. Charles Warner and Irving Warner both went to Miami following the storm to personally inspect the damage to the property of the company there.

Making Fornercrete, Waterproof Cement Products That Can Not Fade

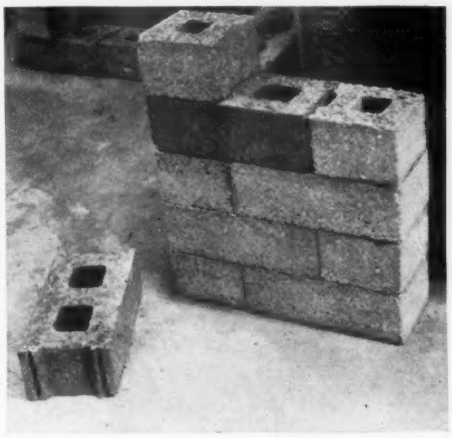
Fornercrete Aggregate Co., Oakland, Calif., Blends Vari-Colored Tested Aggregate to Produce Attractive Pre-Cast Materials

By Jeannette Fox
Oakland, Calif.

MAKING CONCRETE that is absolutely waterproof and will not fade is a new contribution to cement work and a big step in the furtherance in this—our concrete age. The fact that water cannot seep through it and that it weathers frosts without breaking will greatly increase its use.

Further this concrete has color that is an integral and permanent part of it, a fact that will greatly increase its popularity. One can now have a building that is strong and at the same time beautiful. Further, the possibility of color range is unlimited. Any color can be secured, from the most delicate tints to rich sumptuous tones. And it can not fade because its color is a part of the material.

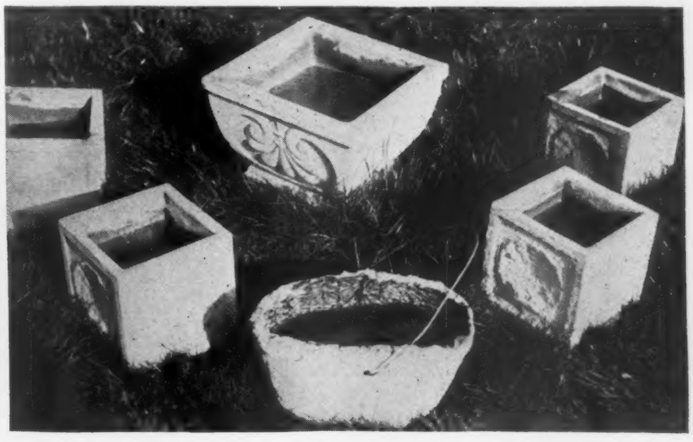
C. K. Forner, founder of the Fornercrete Aggregate Co., spent years investigating rock products. By intensive research and careful experimenting with the natural minerals he deduced formulas whereby he uses the parts to his liking and rejects the parts he considers unfit for the concrete he produces. To test his formulas he made slabs ⅛ in. thick. A record of each one was kept. Then they were placed on the roof of one of the buildings at the plant. The ones that broke or were not waterproof he discarded. From those that were successful he makes his products today. The test was extremely severe for he left the slabs on the roof for years.



Type of block made and method of laying into wall

Now you will wonder why Mr. Forner has so assiduously studied rock products for the purpose of producing concrete. That is one of the steps in which Mr. Forner demonstrates his thought and will explain the deductions he came to through his extensive experiments.

Fornercrete requires rock ground and crushed just as marble is ground and crushed in the making of cast stone. But here Fornercrete not only advances a step beyond ordinary concrete but it advances a step beyond cast stone. After the rock is ground for Fornercrete the aggregate is tested and the minerals unfit for strength are eliminated from the whole. For instance a rock



Some of the ornamental objects of beautiful design, resistive to water and sun, produced at the Fornercrete Aggregate Co. plant

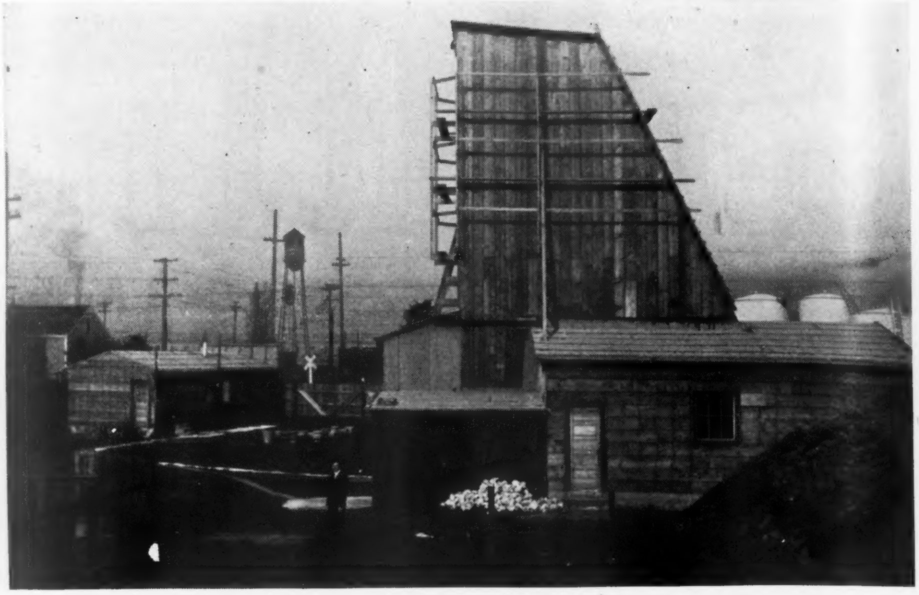
in the field having a streak of soda in it will crumble. Consequently soda or any like minerals are rejected from the aggregate.

Mr. Forner has a plant situated on the outskirts of Oakland, Calif. Here he has equipment one finds at stone casting plants. There is a rock crusher, screens, vats, and molds. Natural rock and sand is brought from the hills to his plant. White rock, white granite, blue rock, yellow rock, black granite, any of a number of minerals. Also hard red cherry brick and various colored gravels. The quarried rock is ground into a fine aggregate, carefully analyzed and dissected, screened into various sizes and weighed into the mixer. The aggregate is mixed to produce the color desired, a little of the white granite, a little of the blue, some of this, some of that. The possibilities are as infinite as pigment coloring. After the exact coloring desired is obtained, the aggregate is mixed according to Mr. Forner's formulas. Then the mixtures are cast in the various molds. Only common labor is used so that the expense is reduced to a minimum. Hand carving is not necessary as the designs are cast in the molds.

Another secret of the durability of Fornercrete lies in the care Mr. Forner takes in allowing for contraction and expansion. All cement mixtures require a certain amount of time for that. But Mr. Forner studied the methods of the Greeks. He compared the success they maintained through the duration of time allowed for the mixing of their materials with the amount of time given concrete today. Consequently he does not pour his mixtures in the molds until the period for contraction and expansion is covered.

By way of proof of the durability of Fornercrete, Mr. Forner has a wire basket about which he has plastered his concrete. It has hung full of water for the past five years. But it has not lost one drop of water through leakage. Also for my benefit Mr. Forner placed vases in bowls of water. At the end of the morning we went back to them and no water had seeped in. The hard surface of Fornercrete successfully resists absorption of water as well as seepage.

The accompanying photos show some of the uses of the product. One contains the wire basket referred to above. The rustic forms are in great use in the Golden Gate Park, San Francisco, Calif. They have everything in the ornamental line, birdbaths, tables, fireplace mantels. In the practical also; colored gravels for roofings, driveways, terrazzo stone work, pebble dash for plaster stucco work. Floors and walls in the naturally colored sands are lovely.



Plant and yard of the Fornercrete Aggregate Co., near Oakland, Calif.

Concrete block walls laid on a foundation of cut stone

Pebble-Faced Block Used with Cut Stone

CONCRETE-FACED block and cut stone are looked upon as rival materials, but there is no reason why they should be enemies. The picture shows the two used together with excellent effect in a residence in Philadelphia. It is one of the many homes that have been built by the John H. McClatchy organization of that city.

Mr. McClatchy has employed all sorts of the better class building materials in the construction of his houses and at one time built a good many of them from the well-known Philadelphia "blue stone," which is not so blue as its name would indicate, the color ranging from a dark gray to a lighter and more brownish tint. The block are faced with pebbles which are yellowed from the iron oxide on their surfaces, and the combination of colors is harmonious and therefore pleasing. Block and ashlar are laid with pointed joints of white mortar.

The fronts of these houses are laid up of cut stone, the separate ashlar being irregular in size and shape. This construction is carried on the sides only to the height of the basement walls. Concrete block are used above this to the roof line. The roof is of concrete tile.

The facing of the block is of pebbles from ¼ in. to ⅜ in. in diameter and it is about 2 in. thick. The blocks are washed free of cement on the face as they are taken from the machine to the steam rooms to be cured. This leaves the aggregate exposed. Other methods of working are well enough known to the block maker, but this was the method employed in making these blocks.

Pebbles of the size used for facing have attained a new value from the coming of concrete masonry units, but they are still produced in excess of demand in many parts of the country. They form a large part of the deposits of southern New Jersey.

New Products Plant for Birmingham

A NEW company has been organized with a capital of $25,000 at Birmingham, Ala., with W. L. Sibley as president and general manager to manufacture "Duntile" products in that city. Mr. Sibley has been general superintendent of the Sibley Face Brick Co., Sibleyville, Ala., for a number of years. The company will be known as the Economy Duntile Co.

The plant will be the first of its kind in the Birmingham section and will employ about 25 men at the start. Birmingham was chosen for a location, according to Mr. Sibley, because the raw materials, cement and aggregate could be supplied directly from manufacturing plants, thus saving freight rates. Further, the transportation facilities for distributing the products throughout a large territory were good.—*Birmingham (Ala.) News.*

Reimers-Kaufman Products Plant Nearly Completed

THE new cement products factory that is being built by the Reimers-Kauffman Co. at Lincoln, Neb., is expected to be ready for occupancy within a short time. The new building is 50x100 ft. and two stories high. It will be equipped with the latest devices for handling materials and machinery for the manufacture of cement blocks. Belt conveyors and elevators will be used in taking heavy materials to and from overhead storage bins. Plans for three additional buildings have been made and it is expected that the plant will be operating early in the spring. In the neighborhood of $20,000 will be spent on buildings and equipment.

The storage yards for the new plant are quite large, extending over an entire block, and are located on three streets. A garage and cement warehouse, 40x50 ft., will be constructed during the winter. The new office will be 25x40 ft. and is now under construction. The company will move to the new location as soon as the factory building is completed.—*Lincoln (Neb.) Journal.*

Output of Masonry, Natural, and Puzzolan Cements in 1925

STATISTICS of hydraulic cements, other than portland cement, in 1925—in which are grouped masonry, natural, and puzzolan cements—as compiled by the Bureau of Mines, Department of Commerce, show an increase in quantity of over 23% and in value of over 27% as compared with the output in 1924.

The output has been expressed in terms of 376-lb. barrels to correspond with the statistics of Portland cement.

MASONRY, NATURAL, AND PUZZOLAN CEMENT SHIPPED FROM PLANTS, 1924 and 1925

State	1924 Producing plants	1924 Barrels of 376 lb.	1924 Value	1925 Producing plants	1925 Barrels of 376 lb.	1925 Value
Alabama*	1			1		
Illinois	1	745,369	$1,147,088	1	939,062	$1,491,333
Indiana	1			1		
Kansas	1			1		
Kentucky	1			1		
Minnesota	2			2		
New York		673,092	859,471		812,663	1,060,250
Ohio	1			1		
Pennsylvania	1			1		
	1			1		
	10	1,418,461	$2,006,559	10	1,751,725	$2,551,583

*Puzzolan only.

Septic Tank Company to Build Plant at Louisville

THE Standard Cement Construction Co. has purchased three acres of land between Cable and Fulton Streets, Louisville, Ky., and plans to begin construction of a new plant and general office building there in the near future, according to J. D. Walker, secretary-treasurer of the organization.

The new plant, which is to be built for the manufacturing of sewage disposal tanks, is to be one of the most modern of its kind in the United States, according to Mr. Walker, who said the company is now manufacturing these tanks at Hollywood, Fla.; Wilmington, N. C.; Ford City, Penn.; Beaver Falls, Penn., and Covington, Ky. The general offices and main plant of the company formerly were located at Wilmington, where the manufacture of septic tanks was started by the company several years ago.

Canada Cement Company Has Prospects for Biggest Year

THERE is every indication that Canada Cement Co. will attain a record year in sales for cement during 1926. Last month, it is understood, was the largest month in in the history of the company and there is no indication of a slowing up in business.

For years, the farm market has constituted over 50% of the company's total distribution. The shattered purchasing power of the farmer in the post-war years would seriously have affected sales had not extensive power developments and road building been under way to keep sales up to something like the average. The farmer has been coming back and in every part of Canada, except the far West, the country trade in cement has shown big increase. Sales have not come up to expectations in Alberta and Saskatchewan because the two bumper crops of last year and 1924 were essentially debt-paying crops. Now that the farmers are squared off, the good return that is assured from the current year's harvest seems likely to bring farm sales of cement back to a new high peak.

Sales of cement for highway construction have shown some decline as the peak of road building has passed, but, nevertheless, the continued rise of the motor car, which is providing the provinces yearly with vast revenues, which they are inclined to spend on further new roads to attract tourists, gives every indication of making this a steady source of business for Canada cement.

Big power developments have, of course, provided an excellent market. The extent of the market can be gaged from the fact that the Isle of Malignes development of the Duke Price Power Co. took some 600,000 bbl. of cement, which is equivalent to one entire month's normal production of all cement plants in Canada at the production rate achieved in recent years. Of course, the cement was not all purchased in one year, but the figures are illuminating as showing the extent of the market for cement provided by these developments. The new development in the Lake St. John district, of the Aluminum Company of America, will take, in the next three to five years, a million barrels of cement. This may be compared with the average monthly production of all cement plants in Canada of between 600,000 and 700,000 bbl.

Concrete Construction in the Near East

THE widespread use of concrete construction by Americans in refugee camps and orphanage buildings seems likely to revolutionize builders' methods throughout the Near East. Heretofore the native houses and buildings have been mainly constructed from adobe, brick and stone. But Americans found the local cements far more useful and almost equally cheap. Even pipes, bowls, sinks and drains were shaped over reinforcements of steel wire mesh with entire success.

The native cement is of volcanic origin and is found in pockets in the rocks ready pulverized for mixing. The best quality comes from the island of Santorini, and is declared to be as easily worked and as durable under local weather conditions as the lower grades of manufactured cement. Few difficulties attend its mining, and its cost is extremely low, only slightly more per cubic yard than sand or gravel.

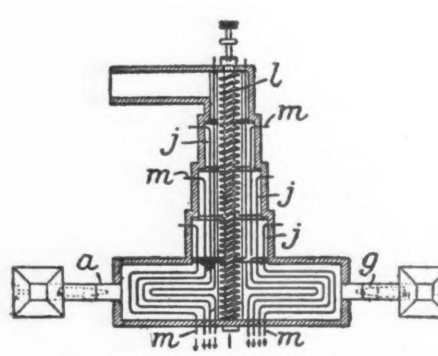
Concrete plumbing was a complete innovation in Greece when introduced by the engineers of the Near East Relief in building their industrial school on the Greek island of Syra. The interiors of bowls and sinks were lined with a white clay which sets with extreme hardness and lasting quality, not unlike porcelain. This clay was the material used by the ancient Greeks as a lining for their aqueducts and reservoirs.

Foreign Abstracts and Patent Review

Viscosity Changes in Reactions on Setting of Cement.—An interesting investigation has been made on the viscosity changes that take place during the reactions between magnesia and aqueous magnesium chloride and the setting of cement. The rate of increase of viscosity of mixtures of magnesium oxide with aqueous solutions of magnesium chloride was studied under various conditions, using a modified Ostwald viscosimeter. The viscosity was found to increase rapidly with rise of temperature and with increase in concentration of magnesia and the higher the temperature at which the magnesia used was calcined, the longer the time required for setting. Greater concentration of magnesium chloride also was found to delay setting, while the addition of sodium chloride or gelatine had little influence.

In certain cases irregularities in the shape of the curve of increase in viscosity with time were observed, and these were shown to be due to supersaturation of magnesia in the solution and to crystallization of oxychloride, followed by colloidal hydration. From the results obtained it was concluded that in the setting of cements and plasters the liquid phase is supersaturated with respect to the solid, which crystallizes out in small aggregates, on which water is then absorbed. *Sci. Papers Inst. Phys. Chem. Res.* (1926), v. 4, 102-128.

Improvement in Kiln for Making Cement and Lime.—A process for lime burning or cement consists in blowing the dry powdered materials into a combustion chamber so as to encounter a flaming jet of fuel.



Cement or lime kiln with heat compensator

The figure shows in plan a suitable apparatus, in which the fuel and the raw material are blown in through nozzles *a* and *g* respectively, and the product, settling in the flue *j* is removed by a conveyor *l*. The pipes *m* are traversed by a cooling fluid, and the heat so extracted may be utilized for raising steam or for other purposes. *British Patent No. 252,780.*

Cement from Refuse.—Refuse is dried by waste and is then ground and mixed with ingredients such as lime and bauxite which form a cement making mixture with the ash of the refuse, and the mixture is then burnt in a cement kiln. The waste heat of the kiln may be employed for drying the refuse. *British Patent No. 251,558.*

Cement for Floors and Plastering on Walls.—Filler materials, such as sand, clay, sawdust, kieselguhr, etc., are mixed in varying proportions with a magnesium oxychloride cement, which consists of approximately 5 parts by weight of magnesium oxide to 1 part by weight of magnesium chloride. Products are thus formed whose water-resisting properties, strength and the like depend on the filler material employed. The following mixture is recommended: Magnesium oxide, 60 parts; sand, 30 parts; kieselguhr, 12 parts; clay, 12 parts; magnesium chloride, 9 parts, and water, 45 parts, all figured by weight. *Chemiker Zeitung* (1926), **50**, 409-410.

Action of Cement on Metal.—Cement attacks metals. Thus cement rusts iron, due to its alkaline content, and on the other hand the alkali exerts a certain protective action on the iron due to the exclusion of oxygen and moisture. The hydrolytically split lime hydrate exerts this action. The action of rusting is not manifested after the cement has hardened, but only during the period of setting.

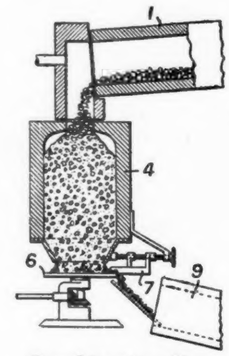
The action of cement on zinc is very interesting. A piece of zinc sheet in contact with setting cement is strongly oxidized at its edges, but the center of the sheet is not touched. Zinc will rust both in an acid and alkaline medium and will remain untouched only in a neutral medium. It appears that a chemical combination takes place between the zinc and the layer of cement in contact with it. Pure cement attacks zinc strongly and this action becomes less as the cement becomes leaner.

Lead must be protected with tar and the like before being allowed to come in contact with the cement. The same is true of the metal aluminum. For further details see *Zement* (1926), 582-3.

Determining Soluble Silica in Cements.—The cement, a one gram sample, or mortar, a four gram sample, is added in small portions to 50 to 60 c.cm. of cold hydrochloric acid of 1.12 sp. gr. The reaction vessel should be cooled in a current of cold water. The solution is filtered and the silica in the filtrate rendered insoluble in the usual manner. If a small quantity of the soluble silica is precipitated the residue is treated with a 5 to 6% sodium carbonate solution, this extract being added to the main filtrate. *Comptes Rendues* (1926), **183**, 53-55.

Ciment Fondu.—Process and apparatus for the manufacture of ciment fondu. The metallic jacket of the rotary kiln is widened in its lower part to the form of a disc and is connected through an electrode with a source of current of high intensity and small voltage. The widened portion of the jacket of the kiln is also made as a movable plate, which is constructed of electrically conductive metal, and this is connected with the other pole from the same current source, and the gap between the two is such that no current can flow. The crude mass of cement material is brought only to the sintering point in the kiln and reaches the space between the electrodes in the widened portion of the kiln in this condition. The current then passes through the mass until it fused. *French Patent No. 604,916.*

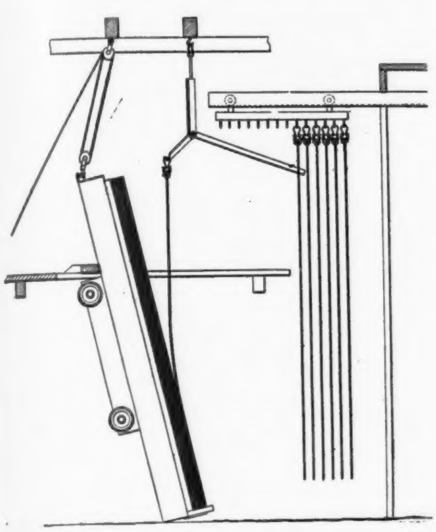
Lime Kiln and Cooler.—Lime discharged from a rotary kiln or from a kiln of another type is allowed to remain quiescent for a certain length of time in order to promote the formation of a high grade product. Thus the lime which is removed from the rotary kiln 1, shown in the illustration is received in a heat insulating chamber 4 in which it is permitted to remain for a sufficient time, for instance, over a period of four hours, and permits the excess heat to complete the burning of any incompletely burned lime. The outlet of the chamber 4 may be a rotary table 6 which is provided with an adjustable knife 7. The lime is discharged into any suitable cooling apparatus, which is shown at 9. The speed of the discharge is so regulated that the chamber 4 is always maintained full. The patentee proposes to grade the limestone so that the largest pieces are not more than two and one-half times the size of the smallest, to limit the thickness of the layer of limestone in the kiln or to use a combination of these methods. *British Patent No. 250,045.*



Combination lime kiln and cooler

Increasing Strength of Finished Portland Cement.—Portland cements are treated after manufacture for the purpose of increasing their strength by adding to them a finely ground vitreous substance, such as glass. This substance is added both to cements and mortars and not only does it increase their strength but also their density and renders them waterproof. Waste glass from glass furnaces may be employed for this purpose. Water glass (sodium silicate) may also be added to promote the decomposition of the vitreous substance. *British Patent No. 252, 210.*

Method of Making Plaster Board. The process of making wall board of the character described consisting in forming the board, allowing the paper cover sheets to attain their full limit of stretch, securing a clamping element along one free edge of the board and suspending the clamping element at its center to have a full and free pivotal movement in all directions. *John F. Makowski, Stockton, Calif., assignor to California Cedar Products Co., Stockton, Calif. U. S. Patent No. 1,597,990.*



Mechanism illustrating how formed and stretched board is suspended in spaced relation to dry

Early High Strength Cement and Process for Manufacture. The process of making a special cement with high initial strength consisting in increasing the alumina content of portland cement and preventing the tendency toward quick-setting by increasing the iron oxide content to bring the ratio of silica to alumina and iron oxide less than 1.8, the ratio of alumina to iron oxide less than 1.8 and the ratio of iron oxide to alumina less than 1.8, keeping the percentage of silica not over 19%. The sintered cement is to have an approximate composition of 14 to 18% silica, 6 to 10% alumina, 5 to 10% iron oxide and 60 to 65% lime. *Hans Kuhl, Berlin, Germany, assignor to A. T. Otto and Sons, New York. U. S. Patent No. 1,594,178.*

Cement Composition. Decorative cement composition for application to any wall board, cement, concrete, plaster, brick, cloth, metals, tiles, etc. The composition consisting of silica, portland cement, white lead, lithopone and fibrous asbestos to which is added cup grease, linseed oil, japan drier, turpentine and kerosene, in such proportion as to possess marked cementive, fire resistant, decorative and desirable drying and setting characteristics, the mixture being agitated with slaked lime to the consistency of a fluffy paste. *Herman Lewis, New York. U. S. Patent No. 1,595,897.*

Artificial Stone and Dolomitic Composition Articles. Shaped articles and artificial stone by carbonating MgO to convert it into a binder while accelerating the reaction by the presence of $CaCO_3$ in the admixture and with or without aggregate. *H. S. Lukens, U. S. Patent No. 1,597,-811.*

Production of Potassium Phosphate and Phosphoric Acid Simultaneously. A process for the production of a fertilizer material containing potassium phosphate and phosphoric acid which consists in igniting a mixture of phosphate rock, a potash silicate and a carbonaceous material in a reducing atmosphere at 1300 deg. C., burning the evolved fume as it escapes from the furnace, and recovering the resulting product in a Cottrell precipitator. *W. H. Ross, R. M. Jones and A. L. Mehring, Washington D. C. U. S. Patent No. 1,598,259.*

Method for Calcining and Clinkering With Recovery of Byproduct Heat and Byproducts. The method of calcining and clinkering and recovering byproducts which consists in passing the material for treatment through a calcining zone, thence passing into a separate clinkering zone, oxidizing a portion of the same therein and effecting a removal from the gases leaving the clinkering zone of their contained alkali metal compounds.

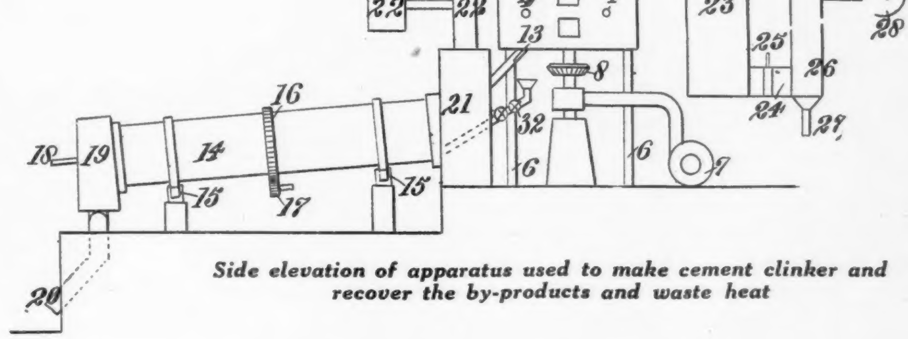
The figure is a side elevation of an apparatus for making portland cement clinker, steam from waste heat and substantially pure alkali-metal sulphates.

One illustrates a conveyor for the raw mix, 2 is a feed box into which the conveyor discharges, and 3 is a calciner of the multiple hearth mechanically rabbled type provided with the burners 4 for liquid, gaseous or pulverized fuel. The calciner is equipped with the usual working doors 5, supports 6, an air blower 7, gear mechanism 8 for rotating the rabbling mechanism and outlet 9 for cooling air from the rabbling mechanism; 10 is an electrical precipitator connected by pipe 10 with the upper end of calciner 3 and 11 are pipes for returning precipitated dust to the calciner, and air exhauster 12 removes gases of combustion and calcination from the calciner.

The hot calcined material drops through spout 13 into rotary kiln 14, which is inclined, and rotates in the cradles 15 in the usual manner; rotation being imparted to the girth gear 16, through the pinion 17, from drive, not shown. Liquid, gaseous or pulverized fuel is introduced by burner 18 into the usual firing hood 19. The clinker drops through chute 20 from the kiln to any suitable place of storage. The gases of combustion from the rotary kiln 14 pass into a chamber 21 and then through a pipe 22 into and through the waste heat boiler 23, then through humidifying chamber 24, into which water is supplied by water pipes 25, and into the electrical or other precipitator 26 of any well known type. The alkali sulphate salts leave the system through a pipe 27 and the gases are exhausted by the exhauster 28. An auxiliary stack 29 is provided with damper 30, which is closed under normal operating conditions. The sulphur burner for burning sulphur to provide SO_2 with some SO_3 is indicated at 22^a and connects with waste heat pipe 22 through which passes the hot gases from calciner 14.

To enable the addition of the small requisite quantity of sulphur in the form of pyrite or pyrrholite to the raw mix entering the calciner 3 through feed box 2, I provide a conventional feed conveyor 31, and if the pyrite or pyrrholite is to be added to the hot calcined mix on its entering the clinkering element, it may be supplied through gate controlled hopper 32. *Robert D. Pike, San Mateo, Calif. U. S. Patent No. 1,594,689.*

The process described above is being experimented with at the plant of the Santa Cruz Portland Cement Co., Davenport, Calif. The results have not been conclusive as yet.—Editor's Note.



Side elevation of apparatus used to make cement clinker and recover the by-products and waste heat

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., at producing point or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	**1.30**	1.30	**1.30**	**1.30**	**1.30**	**1.30**
Chaumont, N. Y.	.50	1.75	1.75	1.50	1.50	1.50
Chazy, N. Y.	.75	1.65	1.65	1.40	1.40	1.40
Cobleskill, N. Y.	1.50	1.35	1.25	1.25	1.25	....
Danbury, Conn.	1.50@2.00	2.00	1.75	1.50	1.35	1.25
Dundas, Ont.	.53	1.05	1.05	.90	.90	.90
Frederick, Md.	.50@ .75	1.20@1.30	1.15@1.25	1.10@1.15	1.10@1.15	1.05@1.10
Munns, N. Y.	1.00	1.40	1.40	1.25	1.25	....
Northern New Jersey	**1.60**	**1.50@1.80**	**1.30@2.00**	**1.40@1.60**	**1.40@1.60**	....
Prospect, N. Y.	**1.00**	**1.50**	**1.40**	**1.30**	**1.30**	....
Walford, Penn.	....	....	1.35h	1.35h	1.35h	1.35h
Watertown, N. Y.	1.00	....	1.75	1.50	1.50	1.50
Western New York	**.85**	**1.25**	**1.25**	**1.25**	**1.25**	**1.25**
CENTRAL						
Afton, Mich.	....	....	.50	....	....	1.50
Alton, Ill.	**1.85**	....	**1.85**	....	....	....
Bloomville. Middlepoint, Dunkirk, Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio; Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Buffalo and Linwood, Iowa	1.00	....	1.10	.90	.95	.95
Carey, Ohio	1.05	1.05	1.05	1.05	1.05	1.05
Chasco, Ill.	1.00@1.30	....	1.00@1.15	....	1.00@1.15	....
Columbia and Krause, Ill.	1.00@1.50	.90@1.10	1.20@1.35	1.00@1.20	.90@1.20	....
			Flux 1.50@1.75			
Greencastle, Ind.	1.30	1.25	1.15	1.05	.95	.95
Lannon, Wis.	.80	.80	1.00	1.00	.90	.90
McCook, Ill.	1.00	1.25	1.25	1.25	1.25	1.25
Milltown, Ind.	....	90@1.10	.90@1.15	.90@1.00	.85@.90	.85@.90
River Rouge, Mich.	1.20	1.20	1.20	1.20	1.20	1.20
St. Vincent de Paul, Que.	.75	1.20@1.45	.90@1.15	.90@ .95	.85	.85
Sheboygan, Wis.	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	....
Toledo, Ohio	1.60	1.70	1.70	1.60	1.60	1.60
Toronto, Ont.	1.50	2.00	2.00	1.85	1.85	1.85
Stone City, Iowa	**.75**	....	**†1.10**	**1.05**	**1.00**	....
Waukesha, Wis.	1.10	....	.90	.90	.90	.90
SOUTHERN:						
Alderson, W. Va.	.50	1.35	1.35	1.25	1.20	1.15
Brooksville, Fla.	.75	....	2.65	2.65	2.40	2.00
Cartersville, Ga.	1.50	1.50	1.50	1.35	1.25	1.15
Chico, Texas	1.00	1.35	1.35	1.25	1.15	1.00
El Paso, Tex.	1.00	1.00	1.00	1.00	....	....
Ft. Springs, W. Va.	**.50**	**1.60**	**1.50**	**1.35**	**1.25**	....
Graystone, Ala.			Crusher run, 1.00 per ton			
Kendrick and Santos, Fla.			3½ in. and less, 1.00 per ton			
New Braunfels, Tex.	.30@1.00	1.00@1.30	1.00@1.30	.70@1.00	.70@ .90	....
Olive Hill, Ky.	**.50@1.00‡**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
Rocky Point, Va.	**.50@1.00**	**1.40@1.60**	**1.30@1.40**	**1.15@1.35**	**1.10@1.20**	**1.00@1.05**
WESTERN:						
Atchison, Kans.	.25	1.90	1.90	1.90	1.90	1.80
Blue Springs & Wymore, Neb.	**.25**	**1.45**	**1.45**	**1.35c**	**1.25d**	**1.20**
Cape Girardeau, Mo.	1.25	....	1.25	1.25	1.10	....
Kansas City, Mo.	1.00	1.50	1.50	1.50	1.50	1.50
Rock Hill, St. Louis Co., Mo.	1.45	1.45	1.45	1.45	1.35	1.35

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	**.80**	**1.70**	**1.45**	**1.20**	**1.05**	....
Duluth, Minn.	.90	2.25	1.90	1.50	1.35	**1.35**
Dwight, Calif.	1.00	1.00	1.00	.90	.90	....
Eastern Maryland	**1.00**	**1.60**	**1.60**	**1.50**	**1.35**	**1.35**
Eastern Massachusetts	**.85**	**1.75**	**1.75**	**1.25**	**1.25**	**1.25**
Eastern New York	**.75**	**1.25**	**1.25**	**1.25**	**1.25**	**1.25**
Eastern Pennsylvania	**1.10**	**1.70**	**1.60**	**1.50**	**1.35**	**1.35**
Knippa, Texas	2.50	2.00	1.55	1.25	1.15	1.15@1.50
New Haven. New Britain, Meriden & Wallingford, Conn.	.80	1.70	1.45	1.20	1.05	....
Northern New Jersey	1.50e	2.00	1.80	1.40	1.40	....
Oakland and El Cerito, Cal.	1.00	1.00	1.00	.90	.90	....
San Diego, Calif.	....	2.75	2.55	2.35	2.35	....
Springfield, N. J.	1.75	2.10	2.10	1.70	1.60	1.60
Toronto, Ont.	....	3.53@4.00	....	3.00@3.75	....	....
Westfield, Mass.	**.60**	**1.50**	**1.35**	**1.20**	**1.10**	....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley, Montello and Red Granite, Wis.—Granite	**1.80**	**1.70**	**1.50**	**1.40**	**1.40**	....
Coldwater, N. Y.—Dolomite			**1.50 all sizes**			
Columbia, S. C.	.75	2.00	1.75	1.75	1.60	1.60
Eastern, Penn.—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Penn.—Quartzite	**1.20**	**1.35**	**1.25**	**1.20**	**1.20**	**1.20**
Lithonia, GGa.	.75	2.00b	1.75	1.40	1.40	1.25
Lohrville, Wis.—Granite	**1.65**	**1.70**	**1.65**	**1.45**	**1.50**	....
Middlebrook, Mo.	3.00@3.50	....	2.00@2.25	2.00@2.25	....	1.25@3.00
Richmond, Calif.—Quartzite	**.75**	....	**1.00**	**1.00**	**1.00**	....
Somerset, Pa. (sand-rock)	**1.85@2.00a**	....	**1.35@1.50**	....	**1.00@1.50**	....
Toccoa, Ga.	....	1.35	....	1.30	1.30	1.25

*Cubic yd. †1 in. and less. ‡Two grades. ‖Rip rap per ton. (a) Sand. (b) to ⅜ in. (c) 1 in., 1.40. (d) 2 in., 1.1[illegible] (e) Dust. (f) ¼ in. (h) less 10c discount. (i) 1 in., 1.40.

Agricultural Limestone

(Pulverized)

Alderson, W. Va.—50% thru 50 mesh	1.50
Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 90% thru 100 mesh	**6.00**
Asheville, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	**2.75**
Atlas, Ky.—90% thru 100 mesh	2.00
50% thru 100 mesh	1.00
Belfast and Rockland, Me. (rail), Lincolnville, Me. (water), analysis $CaCO_3$ 90.04%; $MgCO_3$ 1.5%, 100% thru 14 mesh, bags	**4.50**
Bulk	3.50
Bettendorf and Moline, Ill.—Analysis, $CaCO_3$, 97%; 2% $MgCO_3$; 50% thru 100 mesh, 1.50; 50% thru 4 mesh	1.50
Blackwater, Mo.—100% thru 4 mesh	1.00
Brandon and Middlebury, Vt.—99% thru 70 mesh, burlap, 5.50; paper, 4.50; bulk	3.50
Branchton and Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	**5.00**
Cape Girardeau, Mo.—Analysis, 93% $CaCO_3$, 3.5% $MgCO_3$; pulverized; 50% thru 50 mesh	**1.50**
Cartersville, Ga.—Pulverized, 2.00; 50% thru 50 mesh	1.50
Chaumont, N. Y.—Pulverized limestone, bags, 4.00; bulk	**2.50**
Chico, Texas.—50% thru 50 mesh, bulk	**1.50**
Colton, Calif.—Analysis 90% $CaCO_3$, bulk	**4.00**
Cypress, Ill.—90% thru 100 mesh	**1.35**
Hillsville, Penn.—Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$; 75% thru 100 mesh; sacked	**5.00**
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$: 5.25% $MgCO_3$; pulverized, bags, 4.25; bulk	2.75
Joliet, Ill.—90% thru 100-mesh	4.25
Knoxville, Tenn.—80% thru 200 mesh, 3.00; 80% thru 100 mesh, bags, 3.95; bulk	2.70
Marblehead, Ohio—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.00; bulk	**3.50**
Marion, Va.—Analysis, 90% $CaCO_3$, pulverized, per ton	**2.00**
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 90% thru 100 mesh	3.90@ **4.50**
Milltown, Ind.—Analysis, 94.50% $CaCO_3$, 33% thru 50 mesh, 40% thru 50 mesh; bulk	**1.35@ 1.60**
Olive Hill, Ky.—50% thru 50 mesh, 2.00; 90% thru 4 mesh	**1.00**
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	**2.50@ 2.75**
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	**3.60**
99% thru 100, 85% thru 200; bags, 7.00; bulk	**5.50**
Rocky Point, Va.—Analysis, $CaCO_3$, 95%; $MgCO_3$, 0.75%; 50% thru 100 mesh, burlap bags, 3.50; paper, 3.25; bulk	**2.00**
Syracuse, N. Y.—Analysis, 89% $CaCO_3$; $MgCO_3$, 4%; bags, 4.25; bulk	2.75
Toledo, Ohio. 30% through 50 mesh	2.25
Waukesha, Wis.—90% thru 100 mesh, 4.50; 50% thru 100 mesh, 2.10; 90% thru 50 mesh	1.65
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; 50% thru 100 mesh; bags, 4.00; bulk	**2.50**
West Stockbridge, Mass.—Analysis 90% $CaCO_3$, 50% thru 100 mesh; cloth bags, 4.75; paper, 4.25; bulk	**3.25**

Agricultural Limestone

(Crushed)

Alton, Ill.—Analysis 99% $CaCO_3$, 0.3% $MgCO_3$; 50% thru 4 mesh	**3.00**
Atlas, Ky.—50% thru 4 mesh	.50
Bedford. Ind.—Analysis, 98.5% $CaCO_3$, 0.5% $MgCO_3$; 90% thru 10 mesh	**1.50**
Brandon and Middlebury, Vt.—Pulverized, bags, 5.50; bulk	**3.50**

(Continued on next page)

Agricultural Limestone

Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh	1.75
50% thru 4 mesh	1.50
Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh	.80
Columbia, Krause, Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 90% thru 4 mesh	1.35
Cypress, Ill.—90% thru 50 mesh, 50% thru 100 mesh, 90% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh	1.35
Danbury, Conn.—Analysis, 81 to 85% $CaCO_3$	3.75@ 4.75
Dundas, Ont.—Analysis, 53.8% $CaCO_3$; $MgCO_3$, 43.3%. 100% thru 10 mesh, 40% thru 50 mesh, 25% thru 100 mesh	1.00
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Kansas City, Mo.—50% thru 100 mesh	1.00
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh	2.00
Screenings (¼ in. to dust)	1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk	1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$: 50% thru 50 mesh	1.85@ 2.35
McCook, Ill.—90% thru 4 mesh	.90
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind.—Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 25 to 45% thru 100 mesh	1.60
Moline, Ill., and Bettendorf, Iowa—Analysis, 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Monroe, Mich. — Analysis, $CaCO_3$, 52.03%; 42.25% $MgCO_3$; 30% thru 100 mesh	2.30
Mountville, Va. — Analysis, 62.54% $CaCO_3$; $MgCO_3$, 35.94%, 100% thru 20 mesh; 50% thru 100 mesh bags	5.50
Pixley, Mo.—Analysis, 96% $CaCO_3$; 50% thru 50 mesh	1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh	1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk	.80@ 1.40
Stone City, Iowa. — Analysis, 98% $CaCO_3$; 50% thru 50 mesh	.75
Tulsa, Okla.—Analysis $CaCO_3$, 86.15%, 1.25% $MgCO_3$, all sizes	1.25

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk	3.00
Joliet, Ill.—90% thru 200 mesh	4.00
Piqua, Ohio, sacks, 4.50@5.00 bulk	3.00@ 3.50
Rocky Point, Va.—80% thru 200 mesh, bulk	3.00
Waukesha, Wis.—90% thru 100 mesh, bulk	4.50

Glass Sand

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

Berkeley Springs, W.Va.—Glass sand	2.25
Buffalo, N. Y.	2.00@ 2.50
Cedarville and S. Vineland, N. J.—Damp	1.75
Dry	2.25
Columbus, Ohio	1.00@ 1.50
Estill Springs and Sewanee, Tenn.	1.50
Franklin, Penn.	2.00
Millville, N. J., and Klondike, Mo.	1.75@ 2.25
Los Angeles, Calif.—Washed	5.00
Mapleton Depot, Penn.	2.00@ 2.25
Massillon, Ohio	3.00
Mendota, Va.	2.25@ 2.50
Mineral Ridge and Ohlton, Ohio	2.50
Oceanside, Calif.	3.00
Ottawa, Ill.	.75@ 1.25
Pittsburgh, Penn.	3.00@ 4.00
Ridgway, Penn.	2.50
Rockwood, Mich.	2.75@ 3.25
Round Top, Md.	2.00
San Francisco, Calif.	4.00@ 5.00
St. Louis, Mo.	2.00
Sewanee, Tenn.	1.50
Thayers, Penn.	2.50
Utica, Ill.	1.00@ 1.25
Zanesville, Ohio	2.50

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Beach City, Ohio		1.75
Columbus, Ohio		.30@ 1.50
Dresden, Ohio		1.00
Eau Claire, Wis.	4.25	.65@ 1.25
Estill Springs and Sewanee, Tenn.	1.35@ 1.50	1.35@ 1.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in and less
EASTERN:						
Ambridge & So. H'g'ts. Penn.	1.25	1.25	1.15	.85	.85	.85
Attica and Franklinville, N. Y.	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.40	1.40			2.25	2.25
Buffalo, N. Y.	1.10	.95			.85	
Erie, Pa.		1.00*		1.50*	1.75*	
Farmingdale, N. J.	.48	.48	.75	1.20	1.10	
Hartford, Conn.	.65*					
Leeds Junction, Me.		.50	1.75		1.35	1.25
Machias Jct., N. Y.		.75	.75		.75	
Montoursville, Penn.		1.00	.75	.75	.75	.75
Northern New Jersey	.40@ .50	.40@ .50	1.25	1.25	.90@1.25	
Olean, N. Y.		.75	.75		.75	
Portland, Me.	1.50	1.50	2.75		2.50	
Shining Point, Penn.			1.00	1.00	1.00	1.00
Somerset, Penn.		1.85@2.00				
South Heights, Penn.	1.25	1.25	.85	.85	.85	.85
Washington, D. C.	.60@ .85	.60@ .85	1.70	1.50	1.30	1.30
CENTRAL:						
Algonquin and Beloit, Wis.	.50	.40	.60	.60	.60	.60
Appleton and Mankato, Minn.		.45	1.25	1.25	1.25	1.25
Attica, Ind.			All sizes .75@.85			
Aurora, Oregon, Sheridan, Moronts, Yorkville, Ill.	.60	.50	.40	.50	.60	.55
Barton, Wis.		.75		.75	.75	.85
Chicago district, Ill.	.70	.55	.55	.60	.60	.60
Columbus, Ohio		.70	.70	.70	.70	
Des Moines, Iowa		.40	1.50			
Eau Claire, Wis.	.65@1.25	.45	.80	.95	.95	
Elgin, Ill.		.20*	.50*	1.50*	1.50*	1 50*
Elkhart Lake, Wisc.	.50	.40	.40	.56	.40	.40
Ferrysburg, Mich.		.50@ .80	.60@1.00	.60@1.00		.50@1.25
Ft. Dodge, Iowa	.85	.85	2.05	2.05	2.05	2.05
Grand Haven, Mich.		.60@ .70		.70@ .90		.70@ .90
Grand Rapids, Mich.		.50		.80	.80	.70
Hamilton, Ohio		1.00			1.00	
Hersey, Mich.		.50				.70
Humboldt, Iowa	.50	.50	1.50	1.50	1.50	1.50
Indianapolis, Ind.	.60	.60		.90	.75@1.00	.75@1.00
Joliet, Plainfield and Hammond, Ill.	.60	.50	.50	.60	.60	.60
Mason City, Iowa	.50	.50	1.45	1.45	1.35	1.35
Mattoon, Ill.	.75	.75	.75	.75	.75	.75
Milwaukee, Wis.		1.01	1.21	1.21	1.21	1.21
Moline, Ill.	.60@ .85	.60@ .85	1.00@1.20	1.00@1.20	1.00@1.20	1.00@1.20
Northern New Jersey	.50	.50	1.50	1.25	1.25	
Pittsburgh, Penn.	1.25	1.25	.85	.85	.85	.85
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
St. Louis, Mo.	.93	1.45	1.55a	1.45	1.45	1.45
Terre Haute, Ind.	.75	.60	.90	.75	.75	.75
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	1.50	1.10	1.10	1.10
Zanesville, Ohio		.60	.50	.60	.80	
SOUTHERN:						
Charleston, W. Va.		All sand, 1.40.	All gravel, 1.50.			
Chattanooga, Tenn.		1.65			1.45	
Chattahoochie River, Fla.		.70		1.75		
Eustis, Fla.		.60@ .70				
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.00
Lindsay, Texas					.55	
Macon, Ga.	.50	.50				
New Martinsville, W. Va.	1.00	.90@1.00		1.20@1.30		.80@ .90
Roseland, La.	.50	.50	1.25	1.00	1.00	1.00
WESTERN:						
Kansas City, Mo.	1.00	.70				
Los Angeles district (bunkers)†	1.50	1.40	1.85	1.85	1.85	1.85
Phoenix, Ariz.	1.25*	1.25*	2.25@2.50*	2.00*	1.75*	1.50*
Pueblo, Colo.	.80	.65		1.35		1.20
San Diego, Calif.	.65@ .75	.65@ .75	1.50	1.30	1.10	1.10
Seattle, Wash. (bunkers)	1.25*	1.25*	1.25*	1.25*	1.25*	1.25*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Algonquin and Beloit, Wis.			Dust to 3 in., .40			
Chicago district, Ill.	.35					
East Hartford, Conn.			Sand, .75*			
Ferrysburg, Mich.						.65@1.00
Gainesville, Texas						.55
Grand Haven, Mich.						.70@ .90
Grand Rapids, Mich.				.60		
Hersey, Mich.				.50		
Indianapolis, Ind.		Mixed gravel for concrete work, at .65				
Joliet, Plainfield and Hammond, Ill.	.35	1.25				
Lindsay, Texas						.55
Macon, Ga.	.35	.35				
Mankato, Minn.			Pit run sand, .70			
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Ottawa, Oregon, Moronts and Yorkville, Ill.			Ave. .60 per ton all sizes			
Somerset, Penn.		1.85@2.00		1.50@1.75		
St. Louis, Mo.			Mine run gravel, 1.55 per ton			
Shining Point, Penn.			Concrete sand, 1.10 ton			
Summit Grove, Ind.	.50	.50	.50	.50	.50	.54
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.10	1.00				

(a) ⅝ in. down. (b) River run. (c) 2½ in. and less.
*Cubic yd. †Include freight and bunkerage charges and truck haul. ‡Delivered on job.
(d) Less 10c per ton if paid E.O.M. 10 days. (e) pit run. (f) plus 15c winter loading charge.

Core and Foundry Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton f.o.b. producing plant.

City or shipping point	Molding, fine	Molding, coarse	Molding, brass	Core	Furnace lining	Sand blast	Stone sawing
Aetna, Ill.				.30@ .35			
Albany, N. Y.	2.25	2.00	2.25			3.50	
Arenzville, Ill.	1.50@1.75			1.00			
Beach City, Ohio	1.75@2.00	1.75@2.00		1.75	2.00		1.75
Buffalo, N. Y.	1.50	1.50		2.00@2.50			
Columbus, Ohio	1.25@2.00	1.25@1.75	2.00@2.50	.30@1.50	2.00@2.50	2.75@3.50	1.50@3.00
Dresden, Ohio	1.40	1.50	1.50	1.25	1.50		
Eau Claire, Wis.						3.00	
Elco, Ill.	Ground silica per ton in carloads—18.00@31.00						
Elnora, N. Y.			1.75				
Estill Springs and Sewanee, Tenn.	1.25			1.25		1.35@1.50	
Franklin, Penn.	1.75	1.75	2.00	1.75			
Kasota, Minn.							1.00
Klondike, Mo.	1.75		1.75	1.75	1.75		1.75
Mapleton Depot, Pa.	2.00	2.00		2.00		2.00@2.25	
Massillon, Ohio	2.50	2.50		2.50	2.50		
Mendota, Va.	Ground flint or silex—16.00@20.00 per ton						
Michigan City, Ind.				.20@ .30	.30		
Millville, N. J.				1.75b		3.50	
Montoursville, P'n.				1.25@1.35			
New Lexington, O.	2.00	1.50					
Ohlton, Ohio	1.80b	1.80b		2.00b	1.80b	1.75b	
Ottawa, Ill.	2.50		2.50	1.25	.75	3.50	3.50
Red Wing, Minn.	1.25		1.25	1.50	1.50	3.50	1.50
Ridgeway, Penn.	1.50	1.50					
Round Top, Md.		1.25		1.60		2.25	
San Francisco, Calif.	3.50	4.75	3.50	3.50@5.00	3.50@4.50	3.50@5.00	
Tamalco, Ill.		1.40@1.60					
Tamms, Ill.	Ground silica per ton in carloads—20.00@31.00						
Thayers, Penn.	1.25	1.25		2.00			
Utica, Ill.¶		.50@.85	.50@.90	.60@.75	.60@.90		
Utica, Ill.	.60	.65@ .85		.65	.75		
Utica, Penn.	1.75	1.75		2.00			
Zanesville, Ohio	2.00	1.50	2.00	2.00	2.00		

*Green. †Crude silica, crushed and screened, not washed or dried. ‡Plus 75c per ton for winter loading. ¶Crude. §Crude and dry. (a) Delivered. (b) Damp.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y., Emporium and Dubois, Pa.	2.25	1.25	1.25	1.25	1.25	1.25	1.25
Eastern Penn.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Northern, N. J.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
Reading, Pa.	2.50	1.00		1.25			
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.30*		1.45*	1.45*	1.45*	
Jackson, Ohio		1.05*		1.30*	1.05*	1.30*	
Toledo, Ohio	1.50	1.35	1.35	1.35	1.35	1.35	1.35
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.		1.55*		1.55*	1.55*	1.55*	
Ensley and Alabama City, Ala.	2.05	.80	1.35	1.25	.90	.90	.80
Longdale, Roanoke, Ruessens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15
Woodward, Ala.	2.05*	.80*	1.35*	1.25*	.90*	.90*	

*5c per ton discount on terms.

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.			12.00					2.15e
Buffalo, N. Y.		12.00	12.00	12.00			10.00	1.95d
Chazy, N. Y.	12.50	10.50	8.00	12.00	11.50	16.50	10.00	2.50$_2$
Lime Ridge, Penn.					5.00a			
West Stockbridge, Mass.	12.00	10.00	5.60					2.00t
Williamsport, Penn.			10.00				6.00	
York, Penn.		9.50	9.50	10.50	8.50	10.50	8.50	1.65i
CENTRAL:								
Carey, Ohio	12.50	8.50	8.00		9.00		8.50	2.00
Cold Springs, Ohio	12.50	8.50	8.50		9.00		8.00	
Delaware, Ohio		8.50	8.50	8.50	7.50	.67½	7.50	1.50
Frederick, Md.		10.00	10.00	10.00	8.50	10.00	7.00	
Gibsonburg, Ohio	12.50	8.50	8.50		9.00	11.00	8.50	
Huntington, Ind.	12.50	8.50	8.50		9.00		8.00	
Luckey, Ohio	12.50							
Marblehead, Ohio		8.50	8.50		9.00		8.00	1.50w
Marion, Ohio		8.50	.850				8.00	1.70d
Milltown, Ind.		9.00@10.00		10.00p			8.50q	1.40r
Sheboygan, Wis.	11.50						9.50	.95
Tiffin, Ohio					9.00			
White Rock, Ohio	12.50				9.00	11.00	8.00	
Wisconsin points (f)		11.50					9.50	
Woodville, Ohio	12.50	8.50	8.50	13.50	9.00	11.00	9.00	1.50c
SOUTHERN:								
Allgood, Ala.	12.50	10.00			8.50		8.50	1.50
El Paso, Tex.	22.50						8.00	
Graystone, Ala.	12.50	10.00		12.50			8.50	1.50
Keystone, Ala.		10.00	10.00	10.00	8.50	1.45u	8.50	1.50
Knoxville, Tenn.	20.25	10.00	10.00	10.00			8.50	1.50
Longview, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
Ocala, Fla.	14.00	13.00	12.00	13.00			12.00	1.70
Saginaw, Ala.	12.50	10.00	9.00	10.00			8.50	1.50
WESTERN:								
Kirtland, N. M.							15.00	
Limestone, Wash.	15.00	15.00	10.00	15.00	16.50	16.50	16.50	2.09
Dittlinger, Tex.		12.00@13.00					9.50p	1.50$_4$
San Francisco, Calif.	21.00	19.00	16.50				14.00	2.00
Tehachapi, Calif.			8.00				13.00z	2.20x
Seattle, Wash.	19.00	19.00	12.00	19.00	19.00		18.60	2.30

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) steel; (e) per 180-lb. barrel; (f) dealers' prices, net 30 days less 25c disc. per ton on hydrated lime and 5c per bbl. on lump if paid in 10 days; (i) 180-lb. net barrel, 1.65; 280-lb. net barrel, 2.65; (p) to 11.00; (q) to 8.75; (r) to 1.50; (s) in 80-lb. burlap sacks; (t) to 3.00; (u) two 90-lb. bags; (v) oil burnt; wood burnt 2.25@2.50; (x) wood, steel 2.30; (z) to 15.00; (*) quoted f.o.b. New York; (‡) paper bags; (w) to 1.50 in two 90-lb. bags, wood bbl. 1.60; (¶) to 10.00; (1) 80-lb. paper bags; (2) to 3.00; (3) to 9.00; (4) to 1.60. (5) to 16.00; (6) wood bbl., steel, 1.80.

Miscellaneous Sands

(Continued)

City or shipping point	Roofing sand	Traction
Gray Summit and Klondike, Mo.		1.75
Mapleton Depot, Penn.	2.00	2.00
Massillon, Ohio		2.25
Michigan City, Ind. (Engine sand)		.15@ .25
Mineral Ridge, Ohio	*1.75@ 2.00	*1.75
Montoursville, Penn.		1.25
Ohlton, Ohio	1.80	1.80
Ottawa, Ill.	1.25	
Red Wing, Minn.		1.25
Round Top, Md.	2.25	1.75
San Francisco, Calif.	3.50@ 4.50	3.50@ 4.50
Thayers, Penn.		2.25
Utica, Ill.	1.00@ 3.00	1.00
Warwick, Ohio		2.25
Zanesville, Ohio		2.50

*Wet.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:	
Crude talc (mine run)	3.00@ 4.00
Ground talc (20-50 mesh), bags	10.00
Cubes	55.00
Blanks (per lb.)	.08
Pencils and steel worker's crayons	.08
per gross	1.00@ 1.50
Chatsworth, Ga.:	
Crude Talc	5.00
Ground (150-200 mesh), bulk	10.00
Pencils and steel worker's crayons, per gross	1.00@ 2.00
Chester, Vt.:	
Ground talc (150-200 mesh), bulk	9.00@10.00
Including bags	10.00@11.00
Chicago and Joliet, Ill.:	
Ground (150-200 mesh), bags	30.00
Dalton, Ga.:	
Crude talc	5.00
Ground talc (150-200) bags	10.00@12.00
Pencils and steel workers' crayons, per gross	1.00@ 1.50
Emeryville, N. Y.:	
(Double air floated) including bags; 325 mesh	14.75
200 mesh	13.75
Hailesboro, N. Y.:	
Ground white talc (double and triple air floated) including bags, 300-350 mesh	15.50@20.00
Henry, Va.:	
Crude (mine run)	3.50@ 4.50
Ground talc (150-200 mesh), bulk	9.00@14.50
Joliet, Ill.:	
Roofing talc, bags	10.00
Ground talc (200 mesh), bags	30.00
Keeler, Calif.:	
Ground (200-300 mesh), bags	20.00@30.00
Natural Bridge, N. Y.:	
Ground talc (125-200 mesh), bags	10.00@15.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70%	4.00@ 5.00
Mt. Pleasant, Tenn.—B.P.L. 72%	5.00@ 5.50
Tennessee—F.O.B. mines, gross ton, unground brown rock, B.P.L. 72%	5.00
B.P.L. 75%	6.00
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	8.00@ 9.00

Ground Rock

(2000 lbs.)

Centerville, Tenn.—B.P.L. 65%	7.00
Gordonsburg, Tenn.—B.P.L. 65-72%	4.00@ 4.50
Mt. Pleasant, Tenn.—B.P.L. 65%	8.00
Twomey, Tenn.—B.P.L. 65%	8.00

Florida Phosphate

(Raw Land Pebble)

(Per Ton.)

Florida—F. O. B. mines, gross ton, 68/66% B.P.L., Basis 68%	3.25
70% min. B.P.L., Basis 70%	3.75

Mica

Prices given are net, F.O.B. plant or nearest shipping point.

Franklin, N. C.—Mine run, per lb.	.05@.10
Mine scrap, per ton	20.00
Clean shop scrap, per ton	22.00
Punch mica, per lb.	.05@.10
Pringle, S. D.—Mine run, per ton	125.00
Punch mica, per lb.	.06
Scrap, per ton, carloads	20.00
Rumney Depot, N. H. — per ton, Mine run	360.00
Clean shop scrap	25.00
Roofing mica	35.00
Dry ground, 20 mesh	35.00
40 mesh	40.00
60 mesh	45.00
200 mesh	65.00
Punch mica, per lb.	.10

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Barton, Wis., f.o.b. cars	....	10.50
Brandon, Vt.—English pink and English cream	*11.00	*11.00
Brandon grey	*11.00	*11.00
Brighton, Tenn.—Pink	6.00	5.00
Mixed pink and bronze	4.50@ 6.00	4.50@ 6.00
All colors, mixed sizes	3.50	3.50
Buckingham, Que.—Buff stucco dash	....	12.00@14.00
Chicago, Ill. — Stucco chips, in sacks f.o.b. quarries	....	17.50
Crown Point, N. Y.—Mica Spar	....	9.00@11.00
Dayton, Ohio	....	6.00@24.00
Easton, Penn., and Phillipsburg, N. J.	12.00@16.00	12.00@16.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Bulk marble (crushed, in bags)	†12.50	†12.50
Ingomar, Ohio — Concrete facings and stucco dash	....	6.00@18.00
Middlebrook, Mo.—Red	....	25.00@30.00
Middlebury, Vt.—Middlebury white	....	†9.00
Marble flour, 100% thru 80 mesh	....	3.50
Crusher run marble	....	3.50
Milwaukee, Wis.	....	14.00@34.00
Newark, N. J.—Roofing granules	....	7.50
New York, N. Y.—Red and yellow Verona	....	32.00
Red Granite, Wis.	....	7.50
Stockton, Calif. — "Natrock" roofing grits	....	11.00@20.00
Tuckahoe, N. Y.—Tuckahoe white	12.00	12.00
Wauwatosa, Wis.	....	20.00@32.00
Wellsville, Colo.—Colorado Travertine Stone	15.00	15.00

†C.L. L.C.L. 17.00.
*C.L. including bags; L.C.L. 14.50
‡C.L. including bags, L.C.L. 10.00.

Potash Feldspar

Auburn and Brunswick, Me.—Color, white; 98% thru 140 mesh bulk	19.00
Buckingham, Que.—Color, white; analysis, K_2O, 12-13%; Na_2O, 1.75%; bulk	9.00
De Kalb Jct., N. Y.—Color, white; bulk (crude)	9.00
East Hartford, Conn.—Color, white, 95% through 60 mesh, bags	16.00
96% thru 150 mesh, bags	23.00
East Liverpool, Ohio—Color, white; 98% thru 200 mesh, bulk	19.35
Soda feldspar, crude, bulk, per ton	22.00
Erwin, Tenn.—Color, white; analysis, 12.07% K_2O, 19.34% Al_2O_3; Na_2O, 2.92%; SiO_2, 64.76%; Fe_2O_3, .36%; 98.50% thru 200 mesh, bags, 16.90; bulk	15.50
Glen Tay Station, Ont., color, red or punk; analysis: K_2O, 12.81%, crude (bulk)	7.00
Keystone, S. D.—Prime white, bulk (crude)	8.00
Los Angeles, Calif.—Color, white; analysis, K_2O, 10.35%; Na_2O, 3.62%; Al_2O_3, 18.71%; SiO_2, 65.48%; Fe_2O_3, .17%; 95% thru 200 mesh, bags included, carloads	22.00
Bulk	20.00
Murphsboro, Ill.—Color, snow white; analysis SiO_2, 64.4%; K_2O, 13%; Na_2O, 2.5%; Fe_2O_3, 0.07%; Al_2O_3, 19.3%; 99% thru 200 mesh, bags	21.00
Bulk	20.00
Penland, N. C.—Color, white; crude, bulk	8.00
Ground, bulk	16.50
Tenn. Mills—Color, white; analysis K_2O, 18%; Na_2O, 10%; 65% SiO_2; 99% thru 200 mesh; bulk	18.00
99% thru 140 mesh, bulk	16.00
Toughkenamon, Penn.—Color, cream; 90% thru 200 mesh, bags 14.00, bulk	10.00
Toronto, Can.—Color, flesh; analysis K_2O, 12.75%; Na_2O, 1.96%; crude	7.50@ 8.00
Trenton, N. J.—Crude, bulk	12.00@27.00
99% thru 140 mesh; bulk	16.00

(Bags 11 cents each, non-returnable)

Blended Feldspar

(Pulverized)

Tenn. Mills—Bulk .... 16.00@20.00

Chicken Grits

Afton Mich. (limestone) per ton	10.00
Belfast and Rockland, Me.—(Limestone), bags, per ton	‡10.00
Brandon and Middlebury, Vt., per ton	5.50@10.00
Centerville, Iowa (gypsum) per ton	18.00
Chico, Texas (limestone), 100 lb. bags, per ton	8.00@ 9.00
Danbury, Conn. (limestone)	7.00@ 9.00
Easton, Penn.—Per ton, bulk	3.00
Knoxville, Tenn. (limestone), bags, per ton 7.00; bulk	5.00
Los Angeles Harbor (limestone), 100-lb sack, 1.00; sacks, per ton, 8.50@9.50†; bulk, per ton	6.00@7.00†
Gypsum, Ohio.—(Gypsum) per ton	10.00
Limestone, Wash. (limestone) per ton	12.50
Rocky Point, Va. (limestone) 100 lb. bags, 75c; sacks, per ton, 6.00 bulk	5.00
Seattle, Wash.—(Limestone), bulk, per ton	12.50
Warren, N. H.—(Mica) per ton	7.70@7.90‡
Waukesha, Wis.—(Limestone), per ton	8.00
West Stockbridge, Mass.—(Limestone) bulk	7.50@9.00*

*L.C.L.
†Less than 5-ton lots.
‡C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass.	*17.00
Brighton, N. Y.	*19.75
Dayton, Ohio	12.00@13.50
Detroit, Mich.	15.00
Farmington, Conn.	13.00
Flint, Mich.	¶12.50@16.00
Grand Rapids, Mich.	12.00
Hartford, Conn.	*19.00
Jackson, Mich.	12.25
Lancaster, N. Y.	12.50
Madison, Wis.	a12.00
Michigan City, Ind.	11.00
Milwaukee, Wis.	*13.00
Minneapolis and St. Paul, Minn.	11.25
Minnesota Transfer	10.00
New Brighton, Minn.	10.00
Pontiac, Mich.	12.00@13.50
Portage, Wis.	15.00
Prairie du Chien, Wis.	18.00@22.50
Rochester, N. Y.	*19.75
Saginaw, Mich.	13.00
San Antonio, Texas	14.00
Sebewaing, Mich.	11.50
Syracuse, N. Y.	18.00@20.00*
Toronto, Canada	13.00@15.60†
Toronto, Canada	13.10
Wilkinson, Fla.	10.00@12.00

*Delivered on job. †Sales tax included.
‡Less 5%. ¶Dealers' price. (a) Less 1.00 E.O.M. 10 days.

Portland Cement

Prices per bag and per bbl, without bags net in carload lots.

	Per Bag	Per Bbl.
Albuquerque, N. M.	....	3.37
Atlanta, Ga.	....	2.35
Baltimore, Md.	....	2.15
Birmingham, Ala.	....	2.30
Boston, Mass.	....	2.43
Buffalo, N. Y.	....	2.28
Butte, Mont.	.90¼	3.61
Cedar Rapids, Iowa	....	2.34‡
Charleston, S. C.	....	2.35
Cheyenne, Wyo.	.82¾	3.3[illegible]
Cincinnati, Ohio	56¾	2.37‡
Cleveland, Ohio	....	2.29‡
Chicago, Ill.	....	2.10‡
Columbus, Ohio	....	2.24
Dallas, Texas	....	2.10
Davenport, Iowa	....	2.29‡
Dayton, Ohio	.57	2.28
Denver, Colo.	.66¼	2.65
Detroit, Mich.	....	1.95
Duluth, Minn.	....	2.09‡
Houston, Texas	....	2.60
Indianapolis, Ind.	....	2.19
Jackson, Miss.	....	2.50
Jacksonville, Fla.	....	2.20
Jersey City, N. J.	....	2.13
Kansas City, Mo.	....	1.92
Los Angeles, Calif.	.61†	2.44†
Louisville, Ky.	.54¼	....
Memphis, Tenn.	....	2.60
Milwaukee, Wis.	....	2.25‡
Minneapolis, Minn.	....	2.32‡
Montreal, Que.	....	1.36
New Orleans, La.	....	2.20
New York, N. Y.	....	2.05
Norfolk, Va.	....	2.07
Oklahoma City, Okla.	....	2.46
Omaha, Neb.	....	2.36
Peoria, Ill.	....	2.27‡
Philadelphia, Penn.	....	2.21
Phoenix, Ariz.	....	2.91
Pittsburgh, Penn.	....	2.09‡
Portland, Colo.	....	2.80
Portland, Ore.	....	2.60
Reno, Nevada	....	2.91
Richmond, Va.	....	2.34
Salt Lake City, Utah	.70¼	2.81
San Francisco, Cal.	....	2.31
Savannah, Ga.	....	2.50
St. Louis, Mo.	.55	2.20
St. Paul, Minn.	....	2.32‡
Seattle, Wash.	10c discount	2.50
Tampa, Fla.	....	2.25
Toledo, Ohio	....	2.20‡
Topeka, Kans.	....	2.41
Tulsa, Okla.	....	2.33
Wheeling, W. Va.	....	2.07
Winston-Salem, N. C.	....	2.78

NOTE—Add 40c per bbl. for bags.
†Delivered on job in any quantity, sacks extra.
‡Ten cents discount for cash, 15 days.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.	....	1.85
Chattanooga, Tenn.	....	2.45*
Concrete, Wash.	....	2.35
Davenport, Calif.	....	2.05
Detroit, Mich.	....	2.15
Hannibal, Mo.	....	1.85
Hudson, N. Y.	....	1.95
Leeds, Ala.	....	1.95
Mildred, Kans.	....	2.35
Nazareth, Penn.	....	1.95
Northampton, Penn.	....	1.85
Richard City, Tenn.	....	2.05
Steelton, Minn.	....	1.90
Toledo, Ohio	....	2.20
Universal, Penn.	....	1.85

*Including sacks at 10c each.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x36". Wt. 1500 lb. Per M Sq. Ft.	—Plaster Board— ⅜x32x36". Wt. 1850 lb. Per M Sq. Ft.	Wallboard, ⅜x32 or 48". Lgths. 6'-10', 1850 lb. Per M Sq. Ft.
Arden, Nev. and Los Angeles, Calif.	3.00	8.00u	8.00u	10.70u	10.70u	....	....	....	....	11.70u	....	....	....
Centerville, Iowa	3.00	10.00	15.00	10.00	10.00	10.50	13.50	....	....	13.50	....	....	....
Detroit, Mich.	....	....	....	....	....	....	m9.00@11.00o		....	....	....	....	....
Delawanna, N. J.	——	——	——	——	——	8.00	8.25@9.40		....	....	.14½s	.15½s	40.00@41.00
Douglas, Ariz.	....	....	7.00	....	....	15.50d	18.50	....	30.00	15.50	....	....	....
Grand Rapids, Mich.	2.75	6.00	6.00	8.00	9.00	9.00	17.50	....	24.55	20.00	....	....	....
Gypsum, Ohio‡	3.00	4.00	6.00	8.00	9.00	9.00	18.00	7.00	27.00	19.00	....	15.00	30.00
Los Angeles, Calif.	....	....	10.40k	11.10k	....	....	....	....	....	....	....	....	....
Port Clinton, Ohio	3.00	4.00	6.00	10.00	9.00	9.00	21.00	7.00	30.15	20.00	....	20.00	30.00
Portland, Colo.	....	....	....	10.00	....	....	....	....	....	....	....	....	....
San Francisco, Cal.	....	....	14.00	14.40	15.40	....	15.40	....	....	....	....	....	....
Seattle, Wash.	6.50	....	11.00	16.00	....	....	....	....	....	....	....	....	....
Sigurd, Utah	....	....	....	....	....	....	....	....	21.50	....	....	....	....
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	....	....	....	....	20.00	25.00	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ‖to 12.00; ‡prices per net ton, sacks extra; (a) to 25.00; (b) net; (c) gross; (d) hair fibre; (g) delivered; (h) delivered in six states; (i) delivered on job; (k) sacks 12c extra, rebated; (m) includes paper bags; (o) includes jute sacks; (r) including sacks at 15c; (s) per board; (t) to 16.50; (u) includes sacks; (v) F.O.B. N. Y. C. and dealers yard in mill locality.

Market Prices of Cement Products

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point

City of shipping point	Sizes 8x8x16	8x10x16	8x12x16
Camden, N. J.	17.00	....	....
Columbus, Ohio	.16@.18a	....	....
Detroit, Mich.	.16	....	.18
Forest Park, Ill.	18.00*	23.00*	30.00*
Grand Rapids, Mich.	.15	....	....
Graettinger, Iowa	.18@.20	....	....
Indianapolis, Ind.	.13@.15†	....	....
Los Angeles, Calif.¶	5¾x3½x12—55.00	7¾x3½x12—65.00	
Oak Park, Ill.	.18@.21a	....	....
Olivia and Mankato, Minn.	9.50b	....	....
Somerset, Penn.	.20@.22	....	....
Tiskilwa, Ill.	.16@.18†	....	....
Yakima, Wash.	20.00*	....	....

*Price per 100 at plant. †Rock or panel face. (a) Face. ‡Delivered. ¶Price per 1000. (b) Per ton.

Cement Roofing Tile

Prices are net per sq. in carload lots, f.o.b. nearest shipping point unless otherwise stated.

Camden and Trenton, N. J.—8x12, per sq.

Red	15.00
Green	18.00

Chicago, Ill.—per sq. 20.00

Cicero, Ill.—Hawthorne roofing tile, per sq.

	Chocolate Red and Orange	Yellow, Green and Blue	Tan Slate Gray
French and Spanish†	$11.50	$13.50	$12.75
Ridges (each)	.25	.35	.30
Hips	.25	.35	.30
Hip starters	.50	.60	.60
Hip terminals, 2-way	1.25	1.50	1.50
Hip terminals, 4-way	4.00	5.00	5.00
Mansard terminals	2.50	3.00	3.00
Gable finials	1.25	1.50	1.50
Gable starters	.25	.35	.30
Gable finishers	.25	.35	.30
*End bands	.25	.35	.30
*Eave closers	.06	.08	.06
*Ridge closers	.05	.06	.05

*Used only with Spanish tile.

†Price per square.

Houston, Texas.—Roofing Tile, per sq.	25.00
Indianapolis, Ind.—9x15-in.	Per sq.
Gray	10.00
Red	11.00
Green	13.00
Waco, Texas:	Per sq.
4x4	.60

Cement Building Tile

Cement City, Mich	Per 1000
5x8x12	55.00
Detroit, Mich.	Per 100
5x4x12	4.50
5x8x12	8.00
Longview, Wash.	Per 1000
4x6x12	52.00
4x8x12	64.00
Mt. Pleasant, N. Y.:	Per 1000
5x8x12	78.00
Grand Rapids, Mich.:	Per 1000
5x8x12	70.00
Houston, Texas:	
5x8x12 (Lightweight)	80.00
Pasadena, Calif.—(Stone-Tile)	Per 100
4x6x12	4.00
4x8x12	5.50
Tiskilwa, Ill.—8x8, per 100	15.00
Wildasin Spur, Los Angeles, Calif. (Stone-Tile)	Per 1000
3½x6x12	50.00
3½x8x12	60.00
Prairie du Chien, Wis.	14.00 22.50@27.00
Yakima, Wash.—Building tile:	
5x8x12	.10

Cement Drain Tile

Graettinger, Iowa—5 to 36 in., per ton	8.00
Olivia and Mankato, Minn.—Cement drain tile, per ton	8.00
Tacoma, Wash.—Drain tile per ft.:	
3 in.	.04
4 in.	.05
6 in.	.07½
8 in.	.10
Waukesha, Wis.—Drain tile, per ton	9.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	30.00@35.00
Baltimore, Md. (Del. according to quantity)	15.50	22.00@50.00
Camden and Trenton, N. J.	17.00	
Ensley, Ala. ("Slag-tex")	14.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Longview, Wash.	18.00	25.00@75.00
Milwaukee, Wis.	14.00@15.00	30.00@75.00
Mt. Pleasant, N. Y.		14.00@23.00
Omaha, Neb.	18.00	30.00@40.00
Pasadena, Calif.	11.00	....
Philadelphia, Penn.	15.00	20.00
Portland, Ore.	17.00	25.00@75.00
Prairie du Chien, Wis.	14.00	23.00@27.00
Rapid City, S. D.	18.00	25.00@40.00
Waco, Texas	16.50	32.50@125.00
Watertown, N. Y.	20.00	35.00
Wauwatosa, Wis.	14.00	21.00@42.00
Westmoreland Wharves, Penn.	15.00	20.00
Winnipeg, Man.	14.00	22.00
Yakima, Wash.	22.50	....

†Gray. ‡Red.

Trident Mill of Three Forks Portland Resumes Operation

A REPORT in the Helena (Mont.) *Record* states that the officials of the Three Forks Portland Cement Co. have announced that the cement plant at Trident, Mont., will resume production on a full capacity basis within a short time. The mill has not been in operation since February, 1925, all cement shipments having been filled from the large amount of manufactured cement in storage when the plant shut down at that time. Men are being added to the payroll and it is expected that a full force of 140 men will be soon working.

Slack coal for fuel is already being stored and repair work is rapidly going forward in all departments. Recently a large shot was made at the quarry, insuring enough cement material for several months requirements. The company's Hanover plant near Lewistown has been operating to capacity for the past month.

Monolith Portland to Use Natural Gas

THE Monolith Portland Cement Co.'s plant near Tehachapi, Calif., which has been on a fuel oil basis for the past 10 years will soon be using natural gas. Conversion was undertaken after extensive research on the merits and economy of the two fuels.

The Midway Gas Co. has completed plans for construction of a high-pressure transmission line, 35 miles long, which will convey gas from its main transmission line near Rose Station, at the foot of the Tejon Pass, to the Monolith plant. The cost of this line will be in excess of $300,000.

The line will consist of 33 miles of 8-in. pipe and two miles of 6-in. pipe, welded its entire length. Construction will begin immediately and it is expected work will be completed within the next few months.

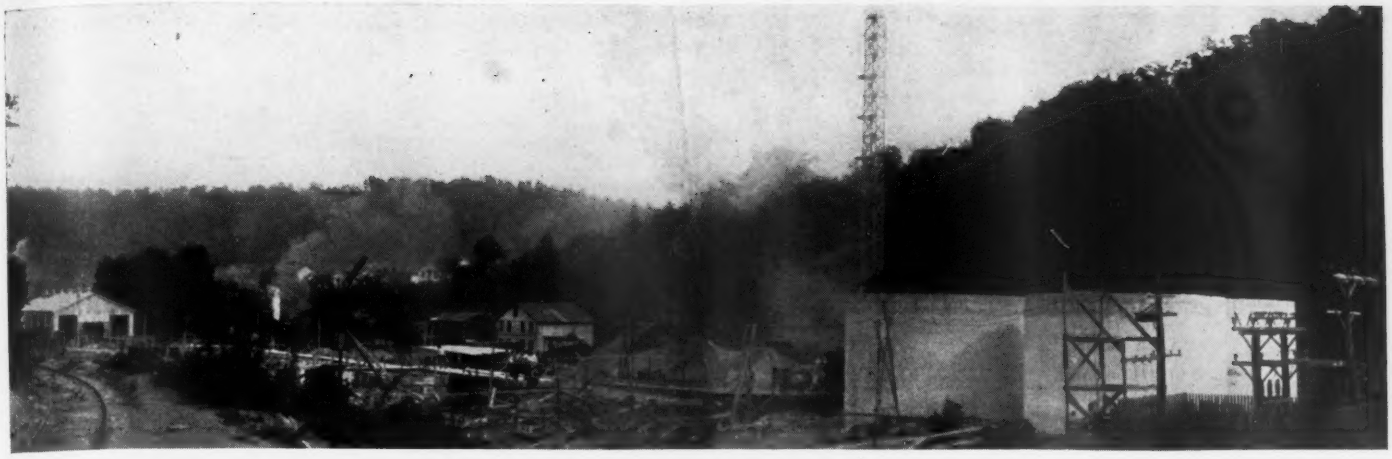
It is estimated that the Monolith plant will consume 7,000,000 cu. ft. of gas each day, aggregating more than 2,500,000,000 ft. annually, in the production of 4000 bbl. cement per day.—*Los Angeles (Calif.) Examiner.*

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted.

Culvert and Sewer	4 in.	6 in.	8 in.	10 in.	12 in.	15 in.	18 in.	20 in.	22 in.	24 in.	27 in.	30 in.	36 in.	42 in.	48 in.	54 in.	60 in.
Detroit, Mich.	15.00 per ton																
Graettinger, Iowa	.04½d	.05½	.08½	.12½	.17½	......	.40	.50	.60	.70	......	......	......	......	......	......	——
G'd Rapids, Mich. (b)	......	......	......	.60	.72	1.00	1.28	......	......	1.92	2.32	3.00	4.00	5.00	6.00	......	——
Houston, Texas	......	.19	.28	.43	.55½	.90	1.30	......	†1.70	2.20	......	......	......	......	......	......	——
Indianapolis, Ind. (a)	......	......	......	.80	.90	1.10	1.30	......	......	1.70	......	2.70	......	......	......	......	——
Longview, Wash.	Sewer pipe 40% off list, culvert—list																
Mankato, Minn. (b)	......	......	......	......	......	......	...	..	......	1.50	1.75	2.50	3.25	4.25	......	......	——
Newark, N. J.	6 in. to 24 in., $18.00 per ton																
Norfolk, Neb.	......	......	......	......	.90	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	......	6.14	7.78
Olivia, Mankato, Minn.	12.00 per ton																
Paullina, Iowa‡	......	......	......	......	......	......	...	2.25	......	2.11	......	2.75	3.58	......	6.14	......	7.78
Somerset, Penn.	......	......	......	......	1.08	1.25	1.65	......	......	2.50	......	3.65	4.85	7.50	8.50	......	——
Tacoma, Wash.	.15	.17	.22½	.30	.40	.55	.70	......	......	......	......	......	......	......	......	......	——
Tiskilwa, Ill. (rein.) (a)	......	......	......	.65	.75	.85	1.10	1.60	......	1.90	......	2.25	3.40	......	5.50	......	——
Wahoo, Neb. (b)	......	......	......	......	1.00	1.13	1.42	......	......	2.11	......	2.75	3.58	4.62	6.14	6.96	7.78
Waukesha, Wis.	12 in. to 60 in. 18.00 per ton																
Yakima, Wash.	$10.00 per ton																

*30-in. lengths up to 27-in. diam., 48-in. lengths after; (a) 24-in. lengths; (b) Reinforced; (c) Interlocking bar reinforced. †21-in. diam. ‡Price per 2 ft. length. (d) 5 in. diam. [1]@1.08 [2]@1.25. [3]@1.65. [4]@2.50. [5]@3.85. [6]@5.00. [7]@7.50.



Plant site of the West Penn Cement Co. at Winfield, Penn. Practically all of the foundations have been poured and railroad sidings placed; the partly completed silos show at the right

Construction Well Under Way for West Penn Cement Plant

WHEN a representative of ROCK PRODUCTS visited the plant site of the West Penn Cement Co. at West Winfield, Penn., a short time ago, it was most evident that the company is building a cement plant.

The accompanying photograph shows what had been accomplished at that time. Practically all of the foundations have been poured and the sidings placed. The McDonald Engineering Co.'s crew was on the ground and had the construction of the silos partly completed, using the sliding form method. Some of the equipment has arrived, but the major units are not to be delivered until October and November. One of the first things accomplished was the erection and equipping of a complete modern machine shop, as the plant site is more than 12 miles from the nearest shop of any kind.

The plant will have many unique features, most of which have to do with efficiency in operation and uniformity of the finished product. A. E. Hiscox, formerly chief chemist at the Pittsburgh Plate Glass Co.'s plant at Fultonham, Ohio, has charge of the company's laboratory and states that tests show the raw materials to run unusually uniform. The company has on its property, in addition to a most plentiful supply of limestone, coal, shale and silica sand, so that gypsum will be the only raw material shipped in.

Ultimately, officials of the company say, the plant will consist of three units of 2000-bbl. capacity each, and the plant is designed in all its details with consideration for future installation of additional units.

As stated in ROCK PRODUCTS of April 3, their new plant is being built on the property formerly owned and operated by the Winfield Stone Co. The quarry on this property is an underground operation and is said to be the oldest limestone mine in America, having been worked for more than 50 years.

The officials and owners are local, excepting General Manager O. J. Binford, who was formerly secretary and general manager of the Southwestern Portland Cement Co. at El Paso, Texas, and later at Osborne, Ohio. Mr. Binford is aided by Consulting Engineer Jones of the Fuller-Lehigh Co., who will stay on the job until the plant is completed. It is expected that finished cement will be made in March. next year.

New Keystone Portland Cement Company Plans

THE KEYSTONE PORTLAND CEMENT CO. has been recently formed and will erect a plant at Bath, Penn. This is in the Lehigh Valley, the district in which about a fourth of all the cement made in the United States is manufactured. The new company is headed by John M. Buckland, of Allentown, Penn., who is president of the National Slag Co. of Allentown. Owing to Mr. Buckland's long connection with the slag industry, the impression got abroad that the new company would use slag as one of its raw materials, but this is not the fact. The new company will make cement of the famous cement rock from which the other Lehigh Valley portland cements are made, and it will make it by the wet process.

The new plant will be the second in the district to use the wet process, the first being the Sandt's Eddy plant of the Lehigh Portland Cement Co. which began producing early this summer. It was fully described in the issues of ROCK PRODUCTS for August 7 and 21.

Fred B. Franks, who is associated with Mr. Buckland and others in the Keystone project, was with the company that started to build the Sandt's Eddy plant, which was sold to the Lehigh company before its construction was completed.

According to a statement made by Mr. Buckland to a ROCK PRODUCTS editor recently, the new plant is to have an output of 1,000,000 bbl. per year. No details of construction are available, for the work of designing the plant is not yet begun. The designer is to be an engineering firm of national reputation and the name will be announced shortly.

It was decided to depart from the usual practice in the Lehigh Valley and to build a wet process mill because those in charge of the enterprise believe that a superior and more uniform grade of cement may be made by this process. It is expected that the product of the new plant will have the property of hardening more quickly than ordinary cements.

The officers of the new company are: John M. Buckland, president; Fred B. Franks, vice-president and general manager; Edward J. Fox, treasurer. The directors, in addition to the officers mentioned, are: Rufus J. Wint, Harvey H. Farr, Charles Groman and Herbert Dillard.

All the above are well known in the Lehigh Valley. Judge Fox, who was formerly of the Pennsylvania Supreme court, is now president of the Easton Trust Co. of Easton. Mr. Wint is at the head of the Wint Lumber Co. of Catasauqua. Mr. Farr is a shoe manufacturer of Allentown and Mr. Groman is a contractor of Bethlehem. Herbert Dillard is county engineer of Northampton county.

Pick Sets Off an Unexploded Charge at Limay Quarry

TWO men were killed and five injured in a recent dynamite explosion, said to be due to carelessness, at the quarry of the Limay Stone Co., Stephensburg, Ky.

According to the workmen, one of the men was splitting stone which had been blasted from the quarry a short time before. His pick struck a stick of dynamite which had not been exploded in the blast and he and another worker, a few feet away, were killed instantly. The others were injured by the flying rock.

The man is said to have known the unexploded charge was in the rock and to have been warned to be careful by fellow workers, as well as by his employers.

Imperial Valley Newest Gravel Plant

DUE to the rapid growth of the cities in the Imperial Valley section of California, the demand for rock products has led to the establishment of a crushing plant at Frink siding on the Southern Pacific railroad, a recent report in the quarterly bulletin published by the California State Mining Bureau states.

The company operating the plant is known as the Orange County Rock Co., Inc. H. G. Wright is president, O. W. Bachman, secretary, and E. S. Cook, manager. Offices are at El Centro, Calif.

The plant employs from 12 to 15 men producing about 1500 tons per day of crushed, washed and screened gravel. The material used is unconsolidated wash containing boulders of schist, rhyolite, andesite and granitic gneiss. The gravel pit is located one mile from the plant in the Coffey Spring wash. Material from the pit is loaded into Western side-dump cars by a Pawling and Harnischfeger steam shovel, and the train of cars hauled by a Plymouth gasoline locotive over broad-gage track to the crushing plant where the material is reduced to four sizes. These are: No. 1, 1½ to 2¼ in.; No. 2, 1 to 1¼ in.; No. 3, ½ to 1 in., and No. 4, $^3/_{16}$ to ½ in.

The entire plant is driven by a 75-hp. semi-Diesel engine. Washing water is obtained from Frink Springs.

Michigan Portland Runs Afoul of Elkins Act

THE Interstate Commerce Commission will be able to exercise the right to regulate shippers as well as carriers in the next fuel emergency, as the result of a United States Supreme Court ruling in the case of the United States against the Michigan Portland Cement Co., of Chelsea, Mich.

William S. Bonerville, counsel for the Interstate Commerce Commission, who with Wallace Vischer, assistant United States district attorney, represented the plaintiff, said that the decision of the Supreme court is one of the most important it has made touching the commission.

"The court's interpretation of the Elkins Act means that shippers can be controlled in fuel emergencies as well as carriers," he said, "and that power will be of great service in the next shortage. In the past we have been handicapped because carriers could claim that they had no guilty knowledge that buyers were obtaining priority orders fraudulently. Now we can prosecute the buyers."

The Federal grand jury returned all indictments against the cement company, since acquired by the State, December 4, 1923. The indictment charged that the company illegally obtained a priority order for five shipments of coal by having them consigned to the Chelsea Municipal Light and Power Co., and changing the delivery point. Under the law the power company could obtain a preferential order, since it was a public utility, from the Interstate Commerce Commission.

On March 9, 1924, counsel for the cement company filed a demurrer, claiming that it had the right to have the delivery point changed. Following an argument by attorneys, Judge Arthur J. Tuttle, of the United States District Court, held with the company. Attorneys for the government took the case to the Supreme Court, however, and here Judge Tuttle was reversed.

The order upholding the Government's contention was brought to the attention of Judge Tuttle today, and the company was fined $5,000 or $1,000 for each consignment.
—*Detroit (Mich.) News.*

Flood Conditions Retard Gravel Plants in Southern Indiana

HIGH water along the Wabash and White rivers in southern Indiana stopped the operations of a large number of sand and gravel plants, but it was expected that by the first or second week in October most of the plants would be able to operate again. Plants at Grayville, Ill., New Harmony, Ind., Vincennes, Ind., Sullivan, Ind., Hazelton, Ind., and Petersburg, Ind., were among those affected by the flood conditions.

Philippine Government Plant Sold to Private Operators

THE board of directors of the National Development Co., Manila, P. I., at a meeting decided to give Manila and Cebu capitalists interested in the purchase of the Cebu Portland Cement Co., an extension of time in which to consider the National company's counter proposal. J. T. Irwin, representing the possible purchasers, had been studying the terms of sale for about four months.

Among the important points in the National company's directors' counter-offer to the Irwin group are that the purchasers put up a bond of $500,000 to guarantee full payment of the cost of the plant; that the cost price of the property be fixed at $2,175,000 the inventory value of the plant as of May 31, 1926; and that the purchasers assume responsibility for a breach of contract suit brought by the Uling-Naga Coal Co., on the Cebu Portland Cement Co.—*Manila (P. I.) Bulletin.*

A later Associated Press report dated Manila, September 16, states that a group of Filipino capitalists have made the purchase of the plant at a price approximating $1,000,000. This is the first sale of government-owned property, which Governor-General Leonard Wood has advocated to get the government out of business. Among the first recommendations General Wood made when assuming his position, five years ago, was for the government to allow private capital to operate a number of concerns which the government owns, including the National Coal Co., the Manila railroad and others.

Keystone Phosphate Buys Bear Lake Properties

ACCORDING to recent announcement in the Paris (Idaho) *Post*, the Keystone Phosphate Co., Nampa, Idaho, has purchased the mine and properties of the Bear Lake Phosphate Co., located near Paris, Idaho.

This property is well known over the entire west and is said to contain large bodies of the high grade phosphate with over 80,000 tons in the stopes. It is equipped with air compressor, motors, rails, cars, etc., installed several years ago when the mine was operating to fair advantage. The tunnel is built for double track.

An engineer engaged by the Keystone Phosphate Co., is expected to arrive shortly to make plans for opening up the mine and start shipments.

Tennessee Slate Deposits To Be Developed

APPLICATION for charter for the Tennessee Slate Products Co., was filed recently at Maryville, Tenn. The incorporators are James L. Cawthon, W. P. Hood, Nealy Morton, John M. Clark, J. O. Law and R. R. Kramer, all of Maryville; Robert D. Coltharp, of Vonore; F. J. Bates, of Asheville, and L. V. Thayer, of New York. The capital was set at $300,000.

The formation of the company culminates the plans of J. L. Cawthon and O. J. Brown, who have in the past few months been engaged in a survey of the deposits in Monroe County on which option was taken. This is said to have shown a good quality and abundance of slate.

It is planned to include the manufacture of slate granules and cement brick with slate granule facing besides the regular roofing slate. The finished products will be carried across the river from the deposit site to the railway line for transportation.

Recently charter was applied for by another concern for development of slate deposits at Wildham, a few miles beyond Sunline, and on the opposite side of the river.
—*Maryville (Tenn.) Times.*

Flames Damage Massaro Gravel Plant

HEAVY damage to equipment and the plant of the Massaro Sand and Gravel Co., Volney, N. Y., is reported to have been sustained through recent fire believed to have started from a short circuit on one of the electric motors. The loss is thought to be about $20,000, which is only partially covered by insurance.

One of the greatest dangers of the fire lay in the fact that there were about 75 sticks of dynamite stored in one of the tool sheds. Mr. Massaro, however, rushed into the shed and removed the explosive to a place of safety. The toolhouse was destroyed by the flames shortly after the explosive was removed.—*Oswego (N. Y.) Times.*

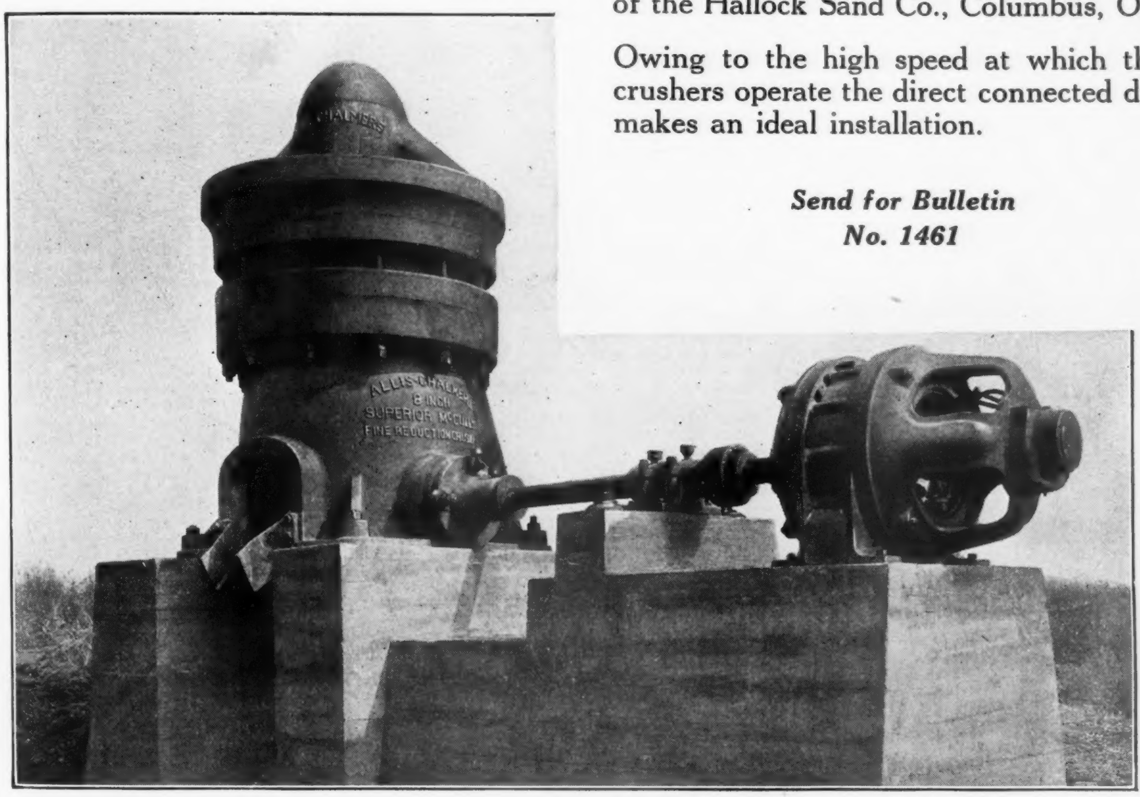
Superior McCully Fine Reduction Gyratory Crusher

The most successful secondary gyratory crusher on the market today

Allis-Chalmers 6" Superior McCully Fine Reduction Gyratory Crusher direct connected to an Allis-Chalmers 50 H. P. Type ANY slip ring motor at 600 R. P. M. installed in the plant of the Hallock Sand Co., Columbus, Ohio.

Owing to the high speed at which these crushers operate the direct connected drive makes an ideal installation.

Send for Bulletin No. 1461



SIZES, CAPACITIES, HORSE POWER AND WEIGHTS

Size of Crusher in Inches	Two Feed Openings, Size Each in Inches	Capacity Per Hour in Tons of 2,000 Pounds — Size of Discharge Opening in Inches												Driving Pulley		H.P. Required	Weight of Crusher in Pounds
		¾	⅞	1	1¼	1½	1¾	2	2¼	2½	3	3½	4	Size in Inches	R.P.M.		
6	6x40	24	28	32	40	48								36x12½	500	40 50	32,000
10	10x52					80	94	107	120	135				36x18½	450	75 100	64,000
18	18x68									250	300	350	400	44x25	400	200 250	182,000

ALLIS-CHALMERS
MILWAUKEE, WIS. U. S. A.

News of All the Industry

Incorporations

Newtown Feldspar Co., Newtown, Conn., $25,000. C. M. Hawley and others.

San Jacinto Gravel Co., Houston, Tex., $100,000. E. H. Combs, Texas agent.

Consolidated Cement Corp., New York, N. Y. Increase capital from $20,000,000 to $21,000,000.

National Rock Asphalt Co., Wilmington, Del., $5,000,000. (Corporation Trust Co. of America.)

Economy Duntile Co., Birmingham, Ala., $25,000. J. D. S. Davis.

Lumber City Sand Co., Lumber City, Pa., $10,000. J. H. Hopkins. To develop sand deposits.

Gifford Sand and Gravel Co., Dallas, Tex. Increased capital from $20,000 to $100,000.

Roa-Hook Sand and Gravel Co., Elizabeth, N. J., $100,000. M. A. Depew, A. F. Sauer and R. A. Sauer. (Atty.: F. K. Sauer, Elizabeth, N. J.)

Trenton Art Stone Co., Ewing Township, N. Y., $100,000; to manufacture stone products, roofing tile, etc.

Searles Slate Co., Inc., New York, $100,000. Hollis H. Searles, 200 Fifth Ave.; Louis E. Eaton and William J. Dodge.

Royal Muralite Corp., Inc., 3,000 shares, no par value. To deal in and manufacture synthetic marble, stone and building material. W. R. Haile, R. H. Allinson, J. D. Wilkinson.

Real-Cast Stone Co., Inc., Brooklyn, N. Y., $10,000; quarry and deal in stone. Nicholas and Joseph Palermo, 715 61st St., Brooklyn; Robert Jordon.

Tremont Concrete Co., Inc., Bronx, $1,000; manufacturing concrete products. Rose De Palma, Hayman Eckman and Joseph Greenstein, 1765 Davidson Ave., Bronx.

Hi-Test Concrete Products Co., Newark, N. J., $100,000. E. E. Thurston, C. F. Giaimo, J. Petha and others. To manufacture cement products, etc. (Attys.: Palleta & Palleta, Newark.)

Yosemite Portland Cement Co., Fresno, Cal. Increased capital stock from 250,000 to 350,000 shares, divided into 200,000 shares of Class A common and 150,000 shares of Class B common, each having a par value of $10. A. Emory Wishon is president and Murray Bourne, secretary.

Pennsylvania-Dixie Cement Corp., Dover, Del., $120,000,000, deal in portland cement, rock cements; 1,200,000 shares of stock, of which 200,000 shares are preferred, $100 each, and 1,000,000 shares of common, no par; total amount of authorized capital, $70,000,000, divided into 200,000 shares of preferred stock. (Corporation Trust Co. of America.)

Sand and Gravel

Warren Township, Mich., has purchased the gravel pit owned by Mary Orr and will use it as a source of supply for keeping roads in repair.

La Grange, Mo., has become a sand center. In five months 2,537 cars of material have been taken from the river beds in the district.

Grand Rapids, Minn.—County commissioners have purchased a 2.41-acre gravel pit near Bigfork.

Halleck & Hill Gravel Co., Bloomfield, Mo., recently held their annual stockholders' meeting at their office in Boomfield. After reviewing the business of the past year the following directors were elected: H. Halleck and G. G. Hill, R. M. Stroll, C. M. Edwards and L. E. Berthe. The meeting adjourned with an optimistic outlook for the coming year's business.

Cotton Belt Gravel Co., Jonesboro, Ark., owned by Thomas Laird, has been sold to a company composed of H. C. and Fred Shauver and Homer Howell. Harvey C. Shauver will be manager.

Bakersfield Rock and Gravel Co., Bakersfield, Calif., is donating all the crushed rock and gravel to be used in the construction of a model home planned by the Kern County Building Trades Council.

Avalon Sand and Gravel Co., Baltimore, Md., is contemplating the purchase of an electrically operated derrick with 75-ft. or longer boom and 3-drum hoist with complete accessories.

Garber Sand and Gravel Co., Norristown, Penn., recently organized by M. G. Garber, is planning the erection of a storage bin near plant operations.

Pratt Rock and Gravel Co. recently made an inspection of their plant at Prattrock, Cal., to consider new improvements for the plant. Harry Bell is superintendent.

Superior Sand and Gravel Co., Seattle, Wash., has added about $1,500 worth of electrical equipment.

Alabama Sand and Gravel Co., Montgomery, Ala., through improvements made within the year, has more than doubled its capacity. A new washing plant was recently completed and another plant will soon be put in operation. Three new locomotives were purchased, making a total of five in constant use at the plant shifting loaded cars, etc.

Quarries

Hibbing, Minn.—Work on the third unit of the Oliver crushing plant has been completed and will soon be put in operation. Two other units were completed last year and are now producing.

Michigan Limestone and Chemical Co., Rogers City, Mich., has awarded a general contract to the Pfeffer Construction Co., Duluth, Minn., for a new one-story machine shop, 125x240 ft., to cost about $90,000 with equipment. It is also considering the erection of a new crusher plant addition.

Lime

Marlbrook Lime Co., Roanoke, Va., is planning the purchase of additional equipment to consist of a ¾-yd. steam shovel, revolving type, and a 24x36-in. jaw crusher.

Black Marble and Lime Co. has started removal of kilns and equipment from the plant of the International Lime Co., Limestone, Wash., which is being dismantled. The equipment, kilns, etc., will be set up and operated at Enterprise, Ore. L. E. Jordan is president of the Black Marble and Lime Co. and W. D. Demorest, general manager.

Muscle Shoals White Lime Co., Sheffield, Ala., recently began operations at their plant. The company was organized a short time ago and will produce a high calcium lime.

Cement

Dixie Portland Cement Co., Richard City, Tenn., has under construction two new kilns, 10x11 ft. 3 in.x343 feet. Reeves Bros. Co., Birmingham, Ala., are the builders of the kilns.

Great Lakes Portland Cement Co., Buffalo, N. Y., is planning the erection of another building to cost about $40,000 at the new mill now under construction.

Louisiana Portland Cement Co., New Orleans, La., has purchased two tracts of land aggregating 533 acres and has an option on an additional tract of 180 acres adjoining, situated on the Mississippi river between Carville and St. Gabriel, La. The clay deposits will be developed as a supply for the new cement plant now under construction in New Orleans. Two new kilns for the plant 8x9x217 ft., built by Reeves Bros., Birmingham, Ala., are in transit.

Cement Products

Collins Concrete Pipe Co., Portland, Ore., has completed plans for a new building, 40x60 ft., one and one-half stories high, to cost about $2000. It will be used for the manufacture of concrete bricks. J. J. Collins states that a new type of brick machine will be installed in the plant, an invention of C. H. Bliss, connected with the company.

Universal Block Co., Lansing, Mich., has rented a new building, 40x60 ft., which they will use for the manufacture of granite face cement block. The firm's plant has been running at full capacity all summer and with the addition of the new building, production will be about 3000 blocks daily.

Miscellaneous Rock Products

J. H. Warner, Chicago, Ill., is reported to have purchased six mining claims in Mariposa county, Calif., said to contain large deposits of talc and pyrophillite. Work will be started at once on the development of the properties.

The North State Feldspar Corp., Micaville, N. C., has taken out group insurance for all of its employees. The policies, premiums of which are taken care of by the corporation, came into effect early in September. The amount of each policy is $500. Rudolph Glatly is general manager of the company.

Personals

H. A. Stelley, superintendent and production manager for the Valley Sand and Gravel Corp., Rochester, N. Y., since June, 1922, at their two plants, one at Canawaugus on the Pennsylvania R. R., the other at Woodsworth Jct. on the Lehigh Valley R. R., has resigned, effective October 1. After that date Mr. Stelley will be connected with the Buffalo Gravel Corp., Buffalo, N. Y., in a similar capacity at their new plant to be built this winter at Hertel Avenue and Niagara River, Buffalo.

Kenneth E. Casparis has again associated himself with the Wisconsin Granite Co., Chicago, Ill., as engineer in charge of construction and maintenance.

Arthur Fretageot, owner of a sand and gravel digging outfit at New Harmony, Ind., has returned from an extensive trip to the west. While gone he attended the national convention of the Phi Gamma Delta held at San Francisco.

Charles Piez, president, Illinois Mfrs. Assn., and chairman, Link-Belt Co., Chicago, Ill., was one of the principal speakers before the Congress of American Industry held recently at Philadelphia, Penn. His address, "The Employer: His Responsibilities," dealing with the fundamentals of the labor problem, was received with great interest by the assemblage.

Charles Baldus, secretary-treasurer of the San Antonio Portland Cement Co., was elected a director of the San Antonio Mfrs. Assn.

Arvid L. Frank, vice-president of the Dewey Portland Cement Co., has accepted a position with the Studebaker Corporation of America, in the export sales department. His new position will take him to the New York office of the Studebaker Co. Mr. Frank had been with the Dewey company since graduating from the University of Kansas, in 1913.

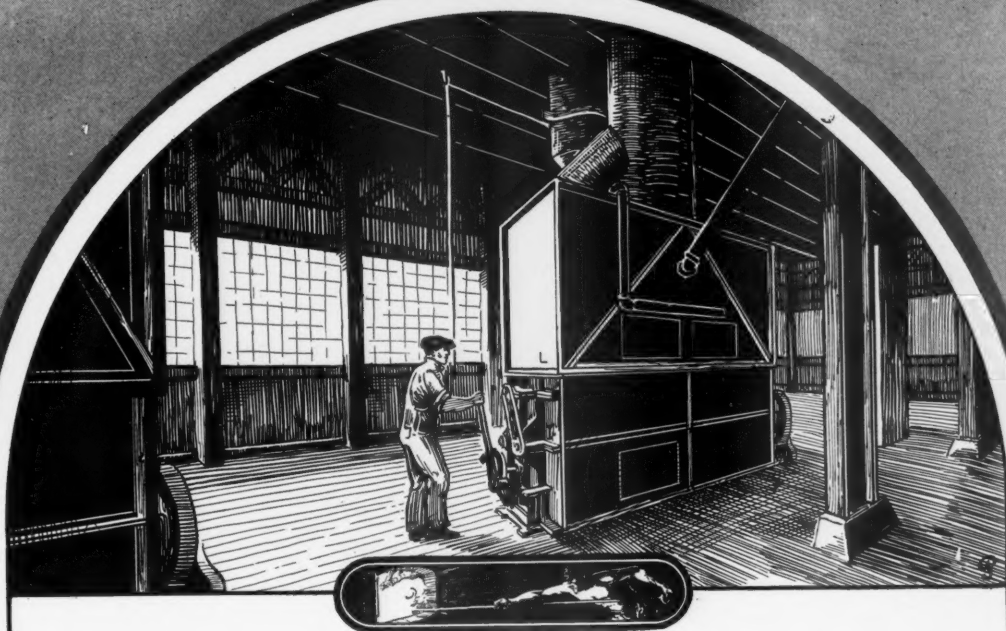
Walter Gray, assistant sales manager of the Dewey Portland Cement Co., has been appointed to the position of sales manager to succeed A. L. Frank, resigned.

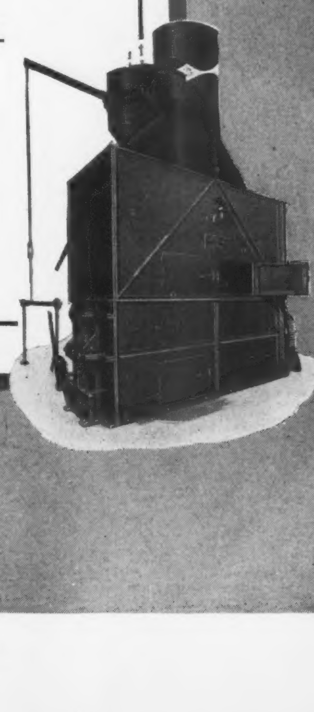
Obituaries

Rea Hart, vice president of the Northern Illinois Supply Co. and Rockford Sand and Gravel Co., died at Rockford, Ill., suddenly, after an illness of 17 months. Besides the widow, Mrs. Eleanor McKee Hart, he is survived by two daughters, Misses Helen and Frances, both residing at the home, 1524 National Avenue, Rockford, Ill.

Lawrence E. Buzard, general sales manager of the Fate-Root-Heath Co., Plymouth, Ohio, died at Cleveland, Ohio, September 12th, 1926, after a brief illness following an operation for appendicitis. He was born at Adario, Ohio, and spent his boyhood in Plymouth, graduating from the Plymouth High School, later attending Ohio State University. Mr. Buzard served as a corporal in the 136th Field Artillery, taking part in most of the major engagements of the World War. In January, 1920, Mr. Buzard accepted a position with the Fate-Root-Heath Co. Starting at the bottom, by close application, industry and ability, he rapidly advanced from one position to another until at the time of his death he was general manager in charge of sales for the company.

L. E. Buzard





Manufacturers

Climax Engineering Co., Clinton, Iowa, announce the appointment of H. J. McClenahan & Co., 615 Water St., Baltimore, Md., as official parts and service station for Climax engines.

Timken Roller Bearing Co., Canton, Ohio, recently entertained about 100 members of the Cleveland Section of the Society of Automotive Engineers. The visitors were taken on a tour of inspection through the Timken plant. Luncheon and a golf tournament and a dinner following were enjoyed by the engineers.

H. K. Ferguson Co., Cleveland, Ohio, have obtained contract for the erection of two new buildings from the Mohawk Limestone Products Co., Jordansville, N. Y. The first is 55x60 ft. and 55 ft. high, structural steel frame covered with sheet metal and steel sash, and the other is also a structural steel building, 53x80 ft., with a yard crane runway about 320 ft., including necessary foundation and retaining wall. The estimated cost is $40,000, not including heating, lighting or plumbing.

Link-Belt Co., Chicago, Ill., announce the opening of a branch office at 107 Foster Bldg., Utica, N. Y., with F. P. Hermann, Jr., in charge.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention ROCK PRODUCTS.

General Electric Bulletins. Bulletin No. **GEA-166** on crane and hoist motors from 15 to 75 hp.; **GEA-434** on varying speed induction motors for elevator service; **GEA-468** on CR3105 drum type controllers for use with d.c. adjustable-speed motors; **GEA-37A** on direct-heat electric furnaces, types AD, RRB and RRC; **GEA-467** on CR7022-A1 automatic starters for slip-ring induction motors; **GEA-448** on live material and rail bonds for mines; **GEA-80** on automatic reduced voltage starters for synchronous motors; **GEA-440** on type CL-1 turn-pull control switch; **GEA-46A** on synchronous motor and control panels, and **GEA-152** on auxiliary welding resistors, type AW. GENERAL ELECTRIC CO., Schenectady, N. Y.

Webster Railroad Car Retarder. Pamphlet describing and illustrating railroad car retarder for control of loading cars. WEBSTER MFG. CO., Chicago, Ill.

Sales Helps for Contractors. Bulletin containing illustrations of sales helps in the form of advertising used in different journals which help contractors or dealers to sell ventilating equipment manufactured by the AMERICAN BLOWER CO., Detroit, Mich.

Insulation Logic. Booklet containing a brief description on the "how" and "why" of heat insulation and a discussion of the advantages derived through its use. CELITE PRODUCTS CO., Los Angeles, Calif.

Marine and Stationary Diesel Engines. Bulletin No. **28** on 4-cycle stationary Diesels of 6 to 25 hp. and No. **50** on marine and stationary Diesels, 6x10 model. Tables of capacities, specifications, details of design, etc. HILL-DIESEL ENGINE CO., Lansing, Mich.

Hoisting and Conveying Equipment. Catalog No. **11** containing useful information on hoists, trolleys, chain wheels, hangers, I-beam switches, cranes, etc. Technical sections on chains, hooks, etc., with dimensions, specifications, details on data and design. Illustrated throughout. WRIGHT MANUFACTURING CO., Lisbon, Ohio.

Easton Bodies. Bulletin No. **305** on Easton bodies for motor chassis and tractors. Features special "Rollover" body for transporting concrete. Details of design, capacities, specifications, etc. EASTON CAR AND CONSTRUCTION CO., Easton, Penn.

Centrifugal Pumps. Bulletin No. **2064-A** on the type "S" centrifugal pumps manufactured by ALLIS-CHALMERS MFG. CO., Milwaukee, Wisc.

Better Bearings. First of a series of four folders containing useful information on bearings. Features conveyor and elevator installations. HYATT ROLLER BEARING CO., Newark, N. J.

Statement of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of ROCK PRODUCTS, published every second Saturday at 542 South Dearborn street, Chicago, Ill., for October, 1926, State of Illinois, County of Cook, ss.

Before me, a notary public in and for the state and county aforesaid, personally appeared Nathan C. Rockwood, who, having been duly sworn according to law, deposes and says that he is the manager of ROCK PRODUCTS, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addreses of the publisher, editor, managing editor, and business managers are: Publisher, Tradepress Publishing Corp.; Editor, Edmund Shaw; Managing Editor, Nathan C. Rockwood; Business Manager, Nathan C. Rockwood.

2. That the owners of 1 per cent or more of the total amount of stock are: W. D. Callender, Nathan C. Rockwood, George M. Earnshaw and F. A. Alter, all of 542 South Dearborn street, Chicago, Ill.

3. That there are no bondholders, mortgagees, or other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest, direct to indirect, in the said stock, bonds, or other securities than as so stated by him.

NATHAN C. ROCKWOOD,
Business Manager.

Sworn to and subscribed before me this 23rd day of September, 1926.

(SEAL) CHARLES O. NELSON.
(My commission expires April 13, 1930.)